BALLOON EXPANSION DRUG DELIVERY CATHETER AND STENT DEPLOYMENT DRUG DELIVERY CATHETER IN RAPID EXCHANGE CONFIGURATION

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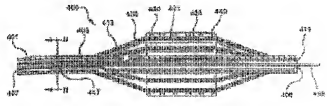
Abstract of **JP 11178929 (A)**
PROBLEM TO BE SOLVED: To achieve quick and easy progress and withdrawal of a catheter. SOLUTION: This catheter is equipped with a catheter shaft 401 and an expansion catheter 412. The expansion balloon 412 has an outer layer 430 which has plural openings 428 (for releasing a drug) and an inner layer. The catheter shaft 401 is equipped with a first lumen 407, a second lumen 405 communicated with the inner layer, and a third lumen 406 to house a guide wire 418. The third lumen 406 has a first opening at the tip end 419 and a second opening 417. Thereby the guide wire 428 is placed in the catheter shaft 401 only in between the first opening and the second opening 417. A stent 440 and deployment means thereof are equipped on the tip end part of the catheter shaft 401.



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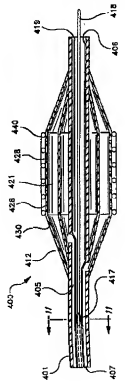
(54)【発明の名称】　迅速交換構成のバルーン膨張型薬剤搬送用カテーテルおよびステント配置型薬剤搬送用カテーテル

(57)【要約】

【課題】　迅速かつ容易なカテーテルの前進および引抜を達成すること。

【解決手段】　カテーテルシャフト４０１と、膨張バルーン４１２と、を具備してなるカテーテルであって、膨張バルーン４１２が、外層４３０および内層を有し、外層４３０は、（薬剤放出のための）複数の開口４２８を有し、カテーテルシャフト４０１は、外層４３０に連通した第１管腔４０７と、内層に連通した第２管腔４０５と、ガイドワイヤ４１８を収容する第３管腔４０６と、を備え、第３管腔４０６は、先端４１９において開口する第１開口と第２開口４１７とを有し、これにより、ガイドワイヤ４１８が、第１開口と第２開口４１７との間においてのみカテーテルシャフト４０１内に配置されており、カテーテルシャフト４０１の先端部には、ステント４４０とその配置手段とが設けられている。



【特許請求の範囲】

【請求項１】　ステント配置型薬剤搬送用カテーテルであって、

先端、該先端の近傍に位置する少なくとも１つの薬剤搬送用ポート（１３０）、および、該薬剤搬送用ポート（１３０）に対して薬剤を供給するための少なくとも１つの薬剤搬送用管腔（１１４）を備えた第１カテーテルシャフトであるとともに、該第１カテーテルシャフト内において、前記先端（１３４）から、前記薬剤搬送用ポート（１３０）よりも基端側に位置しかつ前記第１カテーテルシャフトからガイドワイヤ（１３６）を出させるための開口（１３２）を画成している終点までにわたって延在するガイドワイヤ用管腔（１１６）を備えた第１カテーテルシャフトと、

基端、先端、および、これら基端と先端との間にわたって延在する管腔でありかつ前記第１カテーテルシャフトを受領するための管腔を備えた第２カテーテルシャフト（１１０）と、を具備してなり、

前記第２カテーテルシャフトの前記先端には、ステント配置手段（１２０）が設けられていることを特徴とするステント配置型薬剤搬送用カテーテル。

【請求項２】　前記第２カテーテルシャフト（１１０）は、さらに、前記薬剤搬送用ポート（１３０）よりも先端側に位置する第１閉塞バルーン（１２２）と、該第１閉塞バルーン（１２２）に対して流体の流通が可能に連通している膨張用管腔（１１８）と、を備えることを特徴とする請求項１記載のステント配置型薬剤搬送用カテーテル。

【請求項３】　前記第２カテーテルシャフトは、さらに、前記薬剤搬送用ポート（１３０）よりも基端側に位置する第２閉塞バルーン（１２４）を備え、

前記ガイドワイヤ用管腔（１１６）の前記終点は、前記第２閉塞バルーン（１２４）よりも基端側に位置していることを特徴とする請求項２記載のステント配置型薬剤搬送用カテーテル。

【請求項４】　前記膨張用管腔（１１８）は、前記第１閉塞バルーン（１２２）および前記第２閉塞バルーン（１２４）に対して、流体の流通が可能に連通していることを特徴とする請求項３記載のステント配置型薬剤搬送用カテーテル。

【請求項５】　前記薬剤搬送用管腔（１１４）に対して流体の流通が可能に連通している複数の薬剤搬送用ポート（１３０）が設けられていることを特徴とする請求項１記載のステント配置型薬剤搬送用カテーテル。

【請求項６】　前記閉塞バルーン（１２２、１２４）は、膨張可能なプラスチックチューブを備えることを特徴とする請求項３記載のステント配置型薬剤搬送用カテーテル。

【請求項７】　前記閉塞バルーン（１２２、１２４）は、ブロー成形されていることを特徴とする請求項３記載のステント配置型薬剤搬送用カテーテル。

【請求項８】　さらに、前記第１カテーテルシャフトの少なくとも一部を通しての血液流通を可能とするための灌流手段を備えることを特徴とする請求項２記載のステント配置型薬剤搬送用カテーテル。

【請求項９】　さらに、灌流のために、前記第１カテーテルシャフト内に、付加的な管腔を備えることを特徴とする請求項３記載のステント配置型薬剤搬送用カテーテル。

【請求項１０】　さらに、前記第１カテーテルシャフトの壁において、前記閉塞バルーン（１２２、１２４）よりも基端側に、前記付加的な管腔に対して流体の流通が可能に連通している少なくとも１つの開口を備えることを特徴とする請求項９記載のステント配置型薬剤搬送用カテーテル。

【請求項１１】　さらに、前記第２カテーテルシャフト上に設けられた膨張バルーン（１２０）と、該膨張バルーン（１２０）に対して流体の流通が可能に連通しているようにして前記第１カテーテルシャフトに設けられた膨張用管腔（１１２）と、を備えることを特徴とする請求項１記載のステント配置型薬剤搬送用カテーテル。

【請求項１２】　さらに、前記第２カテーテルシャフト上に設けられた膨張バルーン（１２０）と、該膨張バルーン（１２０）に対して流体の流通が可能に連通しているようにして前記第１カテーテルシャフトに設けられた膨張用管腔（１１２）と、を備え、

前記膨張バルーン（１２０）は、前記閉塞バルーン（１２２、１２４）どうしの間に配置されていることを特徴とする請求項３記載のステント配置型薬剤搬送用カテーテル。

【請求項１３】　前記付加的な管腔は、テーパ状先端を有していることを特徴とする請求項９記載のステント配置型薬剤搬送用カテーテル。

【請求項１４】　先端部、先端（１３４）、および、基端を有するカテーテルシャフト（１１０）と；該カテーテルシャフト（１１０）の前記先端部に取り付けられたステント配置手段（１２０）と；前記カテーテルシャフト（１１０）に対して前記ステント配置手段（１２０）よりも先端側位置に取り付けられた第１閉塞バルーン（１２２）と；前記カテーテルシャフト（１１０）に対して前記ステント配置手段（１２０）よりも基端側位置に取り付けられた第２閉塞バルーン（１２４）と；を具備してなり、

前記カテーテルシャフト（１１０）は、さらに、

前記ステント配置手段（１２０）と前記閉塞バルーン（１２２、１２４）のうちの少なくとも一方との間において、前記カテーテルシャフト（１１０）の前記先端部に設けられた少なくとも１つの薬剤搬送用ポート（１３０）と、

前記閉塞用バルーン（１２２、１２４）に対して流体の

流通が可能に連通した少なくとも１つの膠らませ用管腔（１１８）と、
前記薬剤搬送用ポート（１３０）に対して流体の流通が可能に連通した少なくとも１つの薬剤搬送用管腔（１１４）と、
前記カテーテルシャフト（１１０）の前記先端部内に設けられたガイドワイヤ用管腔（１１６）と、を備え、
前記ガイドワイヤ用管腔（１１６）は、前記カテーテルシャフト（１１０）の前記先端（１３４）において前記カテーテルシャフト（１１０）の外部へと開口する第１開口、および、前記カテーテルシャフト（１１０）のうちの前記第２閉塞バルーン（１２４）よりも基端側であってかつ前記カテーテルシャフト（１１０）の前記基端部よりも実質的に先端側に位置する前記先端部において前記カテーテルシャフト（１１０）の外部へと開口する第２開口（１３２）を有し、
これにより、ガイドワイヤ（１３６）は、前記第１開口を通して前記カテーテルシャフト（１１０）内に入ることができ、また、前記第２開口（１３２）を通して前記カテーテルシャフトから出ることができることを特徴とするステント配置型薬剤搬送用カテーテル。
【請求項１５】　前記カテーテルシャフト（１１０）は、一体物であることを特徴とする請求項１４記載のステント配置型薬剤搬送用カテーテル。
【請求項１６】　先端部、先端、および基端を備えるカテーテルシャフト（４０１）と；該カテーテルシャフトの前記先端部に取り付けられた膨張バルーン（４１２）と；を具備してなり、
前記膨張バルーンは、外層（４３０）および内層（４２０）を有し、
前記内層（４２０）は、前記カテーテルシャフト（４０１）近傍に内部領域を形成し、
前記外層（４３０）および内層（４２０）は、外部領域を形成し、
前記外層（４３０）は、複数の開口（４２８）を有し、
前記カテーテルシャフト（４０１）は、さらに、前記外側領域に対して流体の流通が可能に連通した第１管腔と、前記内側領域に対して流体の流通が可能に連通した第２管腔と、ガイドワイヤ（４１８）を収容するために前記カテーテルシャフトの前記先端部内に設けられた第３管腔と、を備え、
前記第３管腔は、前記カテーテルシャフト（４０１）の前記先端（４１９）において前記カテーテルシャフト（４０１）の外部へと開口する第１開口、および、前記カテーテルシャフト（４０１）のうちの前記膨張バルーン（４１２）よりも基端側であってかつ前記カテーテルシャフト（４０１）の前記基端部よりも実質的に先端側に位置する前記先端部において前記カテーテルシャフト（４０１）の外部へと開口する第２開口（４１７）を有し、
これにより、前記ガイドワイヤ（４１８）は、前記第１開口を通して前記カテーテルシャフト内に入ることができ、また、前記第２開口（４１７）を通して前記カテーテルシャフトから出ることができ、
前記カテーテルシャフト（４０１）の前記先端部には、ステント配置手段（４１２）が設けられていることを特徴とするステント配置型薬剤搬送用カテーテル。
【請求項１７】　前記第１管腔は、薬剤を搬送し得るよう構成されており、前記第２管腔は、膨張用流体を搬送し得るよう構成されていることを特徴とする請求項１６記載のステント配置型薬剤搬送用カテーテル。
【請求項１８】　先端部、先端、および基端を備えるカテーテルシャフト（４０１）と；該カテーテルシャフト（４０１）の前記先端部に取り付けられた薬剤搬送用バルーン（４１２）と；を具備してなり、
前記薬剤搬送用バルーン（４１２）は、該バルーンを貫通して延在する複数のポート（４２８）を有し、
前記カテーテルシャフト（４０１）は、さらに、前記薬剤搬送用バルーン（４１２）に対して流体の流通が可能に連通した少なくとも１つの搬送用管腔、および、ガイドワイヤ（４１８）を収容するために前記カテーテルシャフトの前記先端部内に設けられた管腔（４０６）を備え、
該管腔（４０６）は、前記カテーテルシャフト（４０１）の前記先端（４１９）において前記カテーテルシャフトの外部へと開口する第１開口、および、前記カテーテルシャフト（４０１）のうちの前記薬剤搬送用バルーン（４１２）よりも基端側であってかつ前記カテーテルシャフト（４０１）の前記基端よりも実質的に先端側に位置する前記先端部において前記カテーテルシャフト（４０１）の外部へと開口する第２開口（４１７）を有し、
これにより、前記ガイドワイヤ（４１８）は、前記第１開口を通して前記カテーテルシャフト（４０１）内に入ることができ、また、前記第２開口（４１７）を通して前記カテーテルシャフト（４０１）から出ることができ、
前記カテーテルシャフト（４０１）の前記先端部には、ステント配置手段（４１２）が設けられていることを特徴とするステント配置型薬剤搬送用カテーテル。
【請求項１９】　さらに、灌流用管腔を具備することを特徴とする請求項１８記載のステント配置型薬剤搬送用カテーテル。
【請求項２０】　前記灌流用管腔は、前記カテーテルシャフト（４０１）の前記先端から、前記カテーテルシャフト（４０１）の前記基端までにわたって、延在していることを特徴とする請求項１９記載のステント配置型薬剤搬送用カテーテル。
【請求項２１】　前記灌流用管腔は、前記カテーテルシャフト（４０１）の前記先端（４１９）から、前記薬剤搬送用バルーン（４１２）よりも基端側の終点までにわ

たって延在しており、
前記カテーテルシャフト（４０１）は、さらに、前記灌流用管腔の前記終点近傍に位置するとともに、前記灌流用管腔内に血液が入り得るよう、前記灌流用管腔に連通するように前記カテーテルシャフト（４０１）を貫通して延在する少なくとも１つのポートを備えていることを特徴とする請求項１９記載のステント配置型薬剤搬送用カテーテル。
【請求項２２】　前記灌流用管腔は、テーパ状先端を有していることを特徴とする請求項２１記載のステント配置型薬剤搬送用カテーテル。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、バルーン膨張型薬剤搬送用カテーテルおよびステント配置型薬剤搬送用カテーテルに関するものであって、カテーテルシャフト内において終端するガイドワイヤ用管腔と、ガイドワイヤをカテーテルシャフトから出すための開口と、を備えている。
【０００２】
【従来の技術】経皮経管動脈形成術（「ＰＴＡ」）および経皮経管冠状動脈形成術（「ＰＴＣＡ」）は、膨張バルーンが血管系を通して狭窄部位へと進められ障壁を開放するために膨張バルーンを膨張させるものであって、今日では、通常的な手術法である。しかしながら、このような手術の約３分の１においては、再狭窄が発生してしまい、さらなる拡張手術が必要とされている。
【０００３】再狭窄を低減させ得る様々な薬剤を、狭窄部位に適用することができる。例えば、ヘパリンのような抗血栓崩壊剤は、閉塞を防止することができる。トロンボゲン形成は、再狭窄をもたらし得るような様々な事象を引き起こすことができる。デキサメタゾンのような抗増殖剤は、円滑な筋肉細胞の移動や増殖を防止することができる。
【０００４】そのような薬剤を拡張部位へと有効的に搬送するために、様々な方法が提案されている。例えば、Ｗｏｌｉｎｓｋｙ氏の米国特許第５，０８７，２４４号には、複数の小孔が形成された薄肉フレキシブルバルーンを備えたカテーテルが、開示されている。血管形成術の完了後に、そのようなバルーンは、拡張部位へと進められ、そして、ヘパリンや他の薬剤によって膨張される。薬剤は、小孔を通して、動脈壁と接触している膨張バルーンから放出される。
【０００５】また、Ｗｏｌｉｎｓｋｙ氏の米国特許第４，８２４，４３６号および米国特許第４，６３６，１９５号には、薬剤搬送用コンジットを備えたカテーテルが、開示されている。薬剤搬送用コンジットは、一対の閉塞バルーンどうしの間に設けられている。一対の閉塞バルーンどうしの間に、同一のカテーテルを使用しての膨張と薬剤搬送との双方を可能とする膨張バルーンが設けられた実施形態が開示されている。
【０００６】Ｓｈｏｃｋｅｙ氏他の米国特許第４，９９４，０３３号には、他の膨張用かつ薬剤搬送用のカテーテルが開示されている。この場合には、外側層内に複数の小孔が形成された二重層バルーンが設けられている。薬剤は、２つの層どうしの間に導入され、バルーンの内部には、膨張用流体が導入される。膨張用流体の圧力によって、狭窄が膨張されるとともに、薬剤が、拡張された組織に対して直接的に適用される。
【０００７】
【発明が解決しようとする課題】薬剤搬送用かつ膨張用のカテーテルは、典型的には、カテーテルのシャフト全体を貫通して延在しているガイドワイヤ用管腔内に収容されたガイドワイヤに沿って、拡張部位にまで進められる。ガイドワイヤとカテーテルとの間の摩擦力のために、カテーテルの前進および取外しが、困難なものとなっており、時間のかかるものとなっている。
【０００８】加えて、カテーテル全体がガイドワイヤを覆っていることにより、ワイヤを覆うカテーテルを挿入または交換する場合には、ガイドワイヤが、カテーテルの長さよりもより長い長さだけ患者の身体から突出している必要がある。このようなガイドワイヤは、長さが約３００ｃｍであり、体外にある部分は、約２３０ｃｍである。そうでなければ、ガイドワイヤを固定することができず、障害近傍における配置を維持することができない。このような長いガイドワイヤに代えて、カテーテルの交換時に、交換ワイヤを、ガイドワイヤのうちの体外にある部分に対して連結することができる。交換ワイヤは、長さが少なくとも１８０ｃｍであることが必要である。いずれの場合においても、長いワイヤを取り扱うために、操作時には、付加的な操作者が必要である。付加的な操作者がいるにしても、交換時のカテーテルの操作は、不便なものである。したがって、手術の長さおよび費用が、無用に増大してしまう。
【０００９】
【課題を解決するための手段】本発明のある実施形態においては、先端、この先端の近傍に位置する少なくとも１つの薬剤搬送用ポート、および、この薬剤搬送用ポートに対して薬剤を供給するための少なくとも１つの薬剤搬送用管腔を備えるカテーテルシャフトを具備してなる薬剤搬送用カテーテルを提案している。カテーテルシャフトは、さらに、カテーテルシャフト内において、カテーテルシャフトの先端から終点までにわたって延在するガイドワイヤ用管腔を備えている。終点は、薬剤搬送用ポートよりも基端側に配置されており、終点の近傍には、ガイドワイヤをカテーテルシャフトから出すための開口が形成されている。したがって、カテーテルシャフトは、体外にわたって延在するガイドワイヤのほんの一部を覆うだけであり、長いガイドワイヤや、交換ワイヤを必要としない。好ましくは、薬剤搬送領域を隔離する

ために、閉塞バルーンが設けられる。また、灌流のための付加的な管腔が設けられることが好ましい。灌流用管腔の先端は、テーパ状とされていることが好ましい。

【0010】本発明の他の実施形態においては、先端部、先端、および基端を備えるカテーテルシャフトを具備する膨張型薬剤搬送用カテーテルを提案している。カテーテルシャフトの先端部には、膨張バルーンが取り付けられる。カテーテルシャフトに対して膨張バルーンよりも先端側位置には、第1閉塞バルーンが取り付けられ、カテーテルシャフトに対して膨張バルーンよりも基端側位置には、第2閉塞バルーンが取り付けられる。カテーテルシャフトは、さらに、膨張バルーンと閉塞バルーンのうちの少なくとも一方との間において、カテーテルシャフトの先端部に、少なくとも1つの薬剤搬送用ポートを備えている。膨張用バルーンに対して流体の流通が可能に連通した少なくとも1つの膨張用管腔が設けられる。閉塞用バルーンに対して流体の流通が可能に連通した少なくとも1つの膨らませ用管腔が設けられる。薬剤搬送用ポートに対して流体の流通が可能に連通した少なくとも1つの薬剤搬送用管腔が、同様に設けられる。

【0011】カテーテルシャフトの先端部内には、ガイドワイヤ用管腔が設けられる。ガイドワイヤ用管腔は、カテーテルシャフトの先端においてカテーテルシャフトの外部へと開口する第1開口、および、カテーテルシャフトのうちの第2閉塞バルーンよりも基端側であってかつカテーテルシャフトの基端部よりも実質的に先端側に位置する先端部においてカテーテルシャフトの外部へと開口する第2開口を有している。ガイドワイヤは、第1開口を通してカテーテルシャフト内に入ることができ、また、第2開口を通してカテーテルシャフトから出ることができる。上述のように、カテーテルシャフト全体がガイドワイヤを覆っていないことにより、長いガイドワイヤも、交換ワイヤも、必要ではない。さらに、狭窄部位の拡張と薬剤搬送との両方を同一のカテーテルでもって行い得ることにより、拡張後の狭窄部位への再配置およびカテーテル置換のための時間遅れといった問題が、回避される。

【0012】本発明による膨張型薬剤搬送用カテーテルのまた別の実施形態においては、カテーテルシャフトの先端部に取り付けられた膨張バルーンは、外層および内層を有している。内層は、カテーテルシャフト近傍に内部領域を形成し、外層および内層は、外部領域を形成する。外層は、複数の開口を有している。第1管腔は、外側領域に対して流体の流通が可能に連通しており、第2管腔は、内側領域に対して流体の流通が可能に連通している。カテーテルシャフトの先端部内には、ガイドワイヤを収容するための、第3管腔が設けられている。第3管腔は、カテーテルシャフトの先端においてカテーテルシャフトの外部へと開口する第1開口、および、カテーテルシャフトのうちの膨張バルーンよりも基端側であってかつカテーテルシャフトの基端部よりも実質的に先端側に位置する先端部においてカテーテルシャフトの外部へと開口する第2開口を有している。ガイドワイヤは、第1開口を通してカテーテルシャフト内に入ることができ、また、第2開口を通してカテーテルシャフトから出ることができる。

【0013】本発明のさらに別の実施形態においては、複数のポート付きの薬剤搬送用バルーンが、カテーテルシャフトの先端部に取り付けられている。カテーテルシャフトは、さらに、薬剤搬送用バルーンに対して流体の流通が可能に連通した少なくとも1つの搬送用管腔、および、ガイドワイヤを収容するためにカテーテルシャフトの先端部内に設けられた管腔と、を備えている。ガイドワイヤ用管腔は、カテーテルシャフトの先端においてカテーテルシャフトの外部へと開口する第1開口、および、カテーテルシャフトのうちの薬剤搬送用バルーンよりも基端側であってかつカテーテルシャフトの基端部よりも実質的に先端側に位置する先端部においてカテーテルシャフトの外部へと開口する第2開口を有している。この場合においても、ガイドワイヤは、第1開口を通してカテーテルシャフト内に入ることができ、また、第2開口を通してカテーテルシャフトから出ることができる。また、灌流のための管腔が設けられることが好ましい。灌流用管腔は、テーパ状先端を有していることが好ましい。

【0014】本発明のさらなる実施形態においては、薬剤搬送手段は、同一カテーテルシャフト内において、空置膨張とバルーン膨張可能ステントの配置との双方と組み合わされている。

【0015】

【発明の実施の形態】図1は、本発明の一実施形態による薬剤搬送用カテーテルを示す図であって、カテーテルの先端部については、拡大して断面で図示されている。図2は、図1に示すカテーテルの先端部を、図1の2－2線に沿って示す断面図である。図3は、図1に示すカテーテルの先端部を、90°回転して示す断面図である。図4は、図3に示すカテーテルの先端部を、図3の4－4線に沿って示す断面図である。図5は、図1に示すカテーテルの基端部を、図1の5－5線に沿って示す断面図である。図6は、図3に示すカテーテルを、膨張した閉塞バルーンとともに示す平面図である。図7は、本発明の第2実施形態の先端部を、平面と断面とで示す図である。図8は、本発明の第3実施形態の先端部を、平面と断面とで示す図である。図9は、本発明の第4実施形態を、平面と断面とで示す図である。図10～図13は、本発明の第5実施形態を示す図である。

【0016】図1～図6は、本発明による薬剤搬送用カテーテル10の一実施形態を示している。図1においては、カテーテル10の先端部が、拡大して断面で示されている。カテーテル10は、カテーテルシャフト12を

備えている。好ましくは、２つの閉塞バルーン２２、２４が、カテーテルシャフト１２の先端部に取り付けられている。カテーテルシャフト１２の先端２６から閉塞バルーン２４近傍の終点１４ａまでにわたって延在する第１管腔１４が、ガイドワイヤ２８を受容し得るよう設けられている。開口３０が、終点１４ａ近傍において、カテーテルシャフト１２の壁に形成されている。好ましくは、第１管腔１４は、カテーテルシャフト１２の周縁部近傍に配置されている。ガイドワイヤ２８は、カテーテルシャフト１２の先端部２６における開口３１を通って、カテーテルシャフト１２の第１管腔１４内へと入ることができ、そして、開口３０から出ることができる。開口３０は、実質的には、カテーテル１０の基端部の先端側に位置している。第１管腔の直径は、約０．０２２インチ（０．５６ｍｍ）とすることができる。ガイドワイヤ２８の先端部は、図１に示すように、使用時において、管腔１４の先端から突出している。カテーテルの先端と開口３０との間の距離は、約５～２５ｃｍであることが好ましい。薬剤搬送用カテーテル１０の総長さは、より長いあるいはより短い長さが可能ではあるけれども、１２０～１６０ｃｍから始めることができる。ガイドワイヤ２８が開口３０を通ってカテーテルシャフト１２から出ることが可能であることにより、過度に長いワイヤを使用する必要がない。また、交換ワイヤを使用する必要がない。というのは、身体から取り外すときには、体外にわたって延在するガイドワイヤのほんの一部だけが、カテーテル１０によって覆われるからである。したがって、本発明のカテーテル１０が身体内に挿入されるあるいは取り外されるときには、ガイドワイヤには、所定位置に保持されるための十分な余裕空間が存在する。本発明によるカテーテル１０においては、ガイドワイヤ２８は、身体から約７５ｃｍ突出するだけである。

【００１７】好ましくは、第２管腔１６が、また、カテーテルシャフト１２の先端２６から、閉塞バルーン２４近傍の終点１６ａまでにわたって、延在している。第２管腔の直径は、約０．０１３インチ（０．３３ｍｍ）とすることができる。好ましくは、複数のポート３２が、第２管腔１６に連通するよう、カテーテルシャフト１２の壁を貫通して形成されている。複数のポート３２は、以下においてさらに説明するように、管腔を通しての血液の能動灌流を可能とすることができる。直径または長さがそれぞれ約０．００３～０．０２０インチ（０．０７６～０．５１ｍｍ）の、２～２０個の円形または楕円形のポート３２が、設けられていることが好ましい。本実施形態においては、３個の灌流用開口３２が設けられている。また、基端閉塞バルーン２４と開口３０との間に、同様に、第１管腔１４を通しての血液の灌流を可能とするための、第１管腔１４に連通するポート３０ａを設けることができる。第２管腔１６の先端１６ｂは、図１に示すように、テーパ状であることが好ましい。これにより、先端１６ｂにおける開口が見えにくくなり、使用時に、第１管腔１４に間違えて、第２管腔１６内にガイドワイヤ２８を挿入してしまうことが防止される。このような構成に代えて、管腔１６を、カテーテルシャフト１２の長さ全体にわたって延在させても良く、これにより、以下説明するように、血液や従来から知られている過フルオロ化合物または再結合性ヘモグロビンの能動灌流が可能とされる。

【００１８】図２は、図１の２－２線に沿う断面図であって、第１管腔１４および第２管腔１６、ポート３２、さらに、第３管腔１８および第４管腔２０を示している。第３管腔１８および第４管腔２０について、図３を参照して説明する。

【００１９】図３は、カテーテル１０の先端部を、９０°回転して示す断面図である。ガイドワイヤ２８は、図示省略されている。図においては、第３管腔１８が示されている。この第３管腔１８は、閉塞バルーン２２、２４に対して、カテーテルシャフト１２を貫通するポート３４を通して、膨張用流体を供給するためのものである。好ましくは、バルーン２２、２４の双方を膨らますために、単一の管腔１８が使用される。第３管腔１８の直径は、約０．０１０（０．２５ｍｍ）とすることができる。同様に、各バルーン２２、２４に対して隔離された複数の管腔を設けることもできる。

【００２０】薬剤を搬送するための第４管腔２０が、また、図示されている。閉塞バルーンどうしの間には、少なくとも１つの薬剤搬送用ポート３６が、カテーテルシャフト１２を貫通して、第４管腔２０に連通するよう設けられている。第４管腔２０の直径は、約０．０１０（０．２５ｍｍ）とすることができる。膨張部位に対する適切な薬剤の搬送を確実なものとするためには、直径または長さがそれぞれ約０．００３～０．０２０インチ（０．０７６～０．５１ｍｍ）の、２～２０個の円形または楕円形のポート３６が、設けられていることが好ましい。図３においては、このようなポートは３個である。任意の所望の薬剤は、膨張部位に対して、第４管腔２０により搬送することができる。図４は、カテーテルシャフト１２の図３の４－４線による断面図であって、図３における複数の管腔の配置状況が示されている。また、付加的な薬剤搬送用管腔を、設けることができる。

【００２１】閉塞バルーン２２、２４は、薬剤搬送時には、膨張部位を隔離し得ることが好ましい。閉塞バルーン２２、２４は、動脈壁のうちの既に膨らませた部分の近傍に薬剤を維持する。これにより、薬剤の吸収および有効性が向上する。図６は、図３の向きのカテーテル１０の平面図であって、薬剤搬送の直前および薬剤搬送時に膨らまされた閉塞バルーン２２、２４が示されている。開口３０、および、開口３０から出ているガイドワイヤ２８、さらに、薬剤搬送用ポート３６もまた、図示

されている。この図においては、灌流用開口３２は、カテーテルの向こう側に位置している。

【００２２】複数の管腔を備えた一体型のカテーテルシャフト１２に代えて、カテーテルシャフト１２は、互いに適切に接着された複数のチューブを備えることができる。加えて、図６において拡大して示すカテーテルシャフト１２の先端部は、シャフトの他の部分よりも、より柔らかい材料から形成することができる。先端部が柔らかい材料から形成されていると、血管系を通しての操作性を向上させることができる。一方、シャフトの残りの部分が、より硬い材料から形成されていると、押込性を良好とすることができる。これら２つの部分は、従来技術において知られているような熱接着あるいは接着剤により、単に結合させることができる。適切な材料については、後述する。カテーテル１０の硬さおよび押込性をさらに向上させるために、ステンレス鋼製のあるいはタングステン製のワイヤ（図示せず）を、また、カテーテルシャフト１２の基端部に設けることができる。

【００２３】再度図１を参照すると、カテーテル１０の基端部には、カテーテルシャフト１２に接続された２つのチューブ７２、７４が設けられている。一方のチューブは、膨張用流体の供給のためのものであって、第３管腔１８に接続されている。他方のチューブは、薬剤の供給のためのものであって、第４管腔２０に接続されている。各チューブには、ハブ７８が連結されている。チューブ７２、７４を通して、閉塞バルーン２２、２４に対して膨張用流体を供給するために、また、任意の所望の薬剤を供給するために、シリンジを使用することができる。カテーテル１０が能動灌流のために適用されており、かつ、第２管腔１６がカテーテルシャフト１２の基端部にまで延在している場合には、第３のチューブ（図示せず）を、第２管腔１６に対して、取り付けることができる。付加的な管腔が設けられている場合には、カテーテルシャフト１２に対して、付加的なチューブを取り付けることができる。あるいは、Ｙアダプタを取り付けることができる。図５は、カテーテルシャフトを、図１の５－５線に沿って示す断面図であって、第３管腔１８および第４管腔２０が示されている。

【００２４】カテーテル１０、およびそれらが拡張での閉塞バルーン２２、２４の外径は、約０．０５６インチ（１．４２ｍｍ）を超えないことが好ましい。これにより、７または８フレンチガイディングカテーテル（７ or ８ French guiding catheter）とともに使用することができる。

【００２５】チューブ７２、７４を受容し得るよう、内側カテーテルシャフトの基端部５２は、おおよそ場所８０において、約０．１４０インチ（３．５６ｍｍ）の外径にまで拡径している。チューブ７２、７４は、熱収縮チューブ８２により、互いに保持されている。チューブ７２、７４は、熱接着または接着剤により、カテーテルシャフトに対して連結されている。

【００２６】第１管腔１４の先端２６は、好ましくは、カテーテルシャフト１２の材料と比較して、より柔らかな材料を有する弾性チップ９６を備えている。チップ９６は、生体組織に接触したときに、広がる、または、曲がる。これにより、血管系を通ってのカテーテルの通過が容易とされ、組織の損傷の防止に役立つ。チップ９６は、Ｄｏｗ Ｃｈｅｍｉｃａｌ Ｃｏｒｐｏｒａｔｉｏｎには超低密度ポリエチレン４６０３から形成することができる。この材料は、１９０℃において０．７～０．９ｇ／１０ｍｉｎのメルトフローインデックス（ＡＳＴＭ Ｄ－１２３８）、および、０．９０３０～０．９０７０ｇ／ｃｃの密度（ＡＳＴＭ Ｄ－７９２）を有している。チップ９６は、また、Ｅｌｆ Ａｔｏｃｈｅｍ Ｄｅｕｔｓｃｈｌａｎｄ ＧｍｂＨによるＰＥＢＡ ２５Ｄのような、ナイロンあるいはポリアミドコポリマーとすることができる。この材料は、最小４９５０ｐｓｉの引張強度（ＡＳＴＭ Ｄ－６３８）、最小６４０％の伸び（ＡＳＴＭ－６３８）、最小２１００ｐｓｉのたわみ率（ＡＳＴＭ Ｄ－７９０）、２５Ｄ±４Ｄのデュロメーター（ＡＳＴＭ Ｄ－２２４０）、および、１４２℃～１５３℃の融点（ＡＳＴＭ Ｄ－３４１８）を有している。チップ９６は、接着剤または熱接着により、カテーテルシャフト１２に対して連結することができる。

【００２７】また、例えば金またはタンタル製の放射線に対して不透明なマーカー９８が、従来から知られているように、ＰＴＡまたはＰＴＣＡ手術時におけるＸ線透視法によるカテーテルの位置観測のために、図１に示すように閉塞バルーン２２、２４内において、カテーテルシャフト１２に、設けられることが好ましい。このようなマーカーは、他の配置、例えば、最後方のポート３２の基端に、設けることもできる。

【００２８】カテーテルシャフト１２、および、閉塞バルーン２２、２４は、好ましくは、シリコン、アクリルイミド、あるいは親水性ポリウレタンコーティングのような、滑り材料でコーティングされている。これにより、従来から知られているように、ガイディングカテーテルを通っての、本発明による薬剤搬送用カテーテル１０の通過が容易とされる。

【００２９】カテーテルシャフトは、カテーテルにとって適切な任意の材料、例えば、線形低密度ポリエチレンまたは高密度ポリエチレン、ナイロン、ポリアミド、ポリアミドコポリマー、ポリウレタン、ポリプロピレン、ポリエステルコポリマー、シリコーンラバー、あるいは、他の非トロンボゲン形成材料から形成することができる。ステンレス鋼製の、あるいは、ニチノール（Ｎｉｔｉｎｏｌ）製の、同様に、例えばＲａｙｃｈｅｍ Ｃｏｒｐｏｒａｔｉｏｎから入手可能なニッケルーチタン合金製の、金属チューブを使用することもできる。

【００３０】適切な線形低密度ポリエチレンは、Ｄｏｗ Ｃｈｅｍｉｃａｌ ＣｏｍｐａｎｙによるＤｏｗｌｅｘ２０３８である。この材料は、１９０℃において０．８５～１．１５ｇ／１０ｍｉｎのメルトフローインデックス（ＡＳＴＭ Ｄ－１２３８）、および、０．９３３０～０．９３７０ｇ／ｃｃの密度（ＡＳＴＭ Ｄ－７９２）を有している。使用可能な高密度ポリエチレンは、Ｑｕａｎｔｕｍ Ｃｈｅｍｉｃａｌ ＣｏｒｐｏｒａｔｉｏｎによるＬＢ ８３２０－００である。この材料は、１９０℃において０．２０～０．３６ｇ／１０ｍｉｎのメルトフローインデックス（ＡＳＴＭ Ｄ－１２３８）、および、最小０．９５６６ｇ／ｃｃの密度（Ｄ－１５０５）を有している。

【００３１】使用可能なナイロンは、Ｈｕｌｓ Ａｍｅｒｉｃａ Ｉｎｃ．によるＬ２１０１Ｆ Ｖｅｓｔａｍｅｄのようなナイロン１２である。この材料は、２．０５～２．２２の相対粘度（ＩＳＯ ３０７）、および、最大０．１０の含水率（ＡＳＴＭ Ｄ－４１０９）を有している。使用可能な他のナイロンは、Ｅｌｆ Ａｔｏｃｈｅｍによる ＰＥＢＡ ７０Ｄである。この材料は、最小８３００ｐｓｉの引張強度（ＡＳＴＭ Ｄ－６３８）、最小４００％の伸び（ＡＳＴＭ Ｄ－６３８）、最小６７，０００ｐｓｉのたわみ率（ＡＳＴＭ Ｄ－７９０）、６９Ｄ±４Ｄのデュロメーター（ＡＳＴＭ Ｄ－２２４０）、および、１６０℃～１８０℃の融点（ＡＳＴＭ Ｄ－３４１８）を有している。

【００３２】使用可能な高密度ポリエチレンは、Ｑｕａｎｔｕｍ Ｃｈｅｍｉｃａｌ Ｃｏｒｐｏｒａｔｉｏｎによる ＬＭ６００７である。この材料は、以下の特性を有している。

引張強度（ＡＳＴＭ Ｄ－６３８）	最小４４００ｐｓｉ
破裂における伸び、％（ＡＳＴＭ Ｄ－６３８）	最小６００％
デュロメーターのＤ係数（ＡＳＴＭ Ｄ－２２４０）	６８±４．５
２４０℃、２１６０ｇにおけるメルトフローインデックス（ＡＳＴＭ Ｄ－１２３８）	０．０７０（ＲＥＦ）
室温におけるたわみ率（ＡＳＴＭ Ｄ－７９０、手法Ｂ）	最小２２０，０００ｐｓｉ
Ｖｉｃａｔ軟化点、℃（ＡＳＴＭ Ｄ－１５２５）	１２５℃（ＲＥＦ）

【００３３】カテーテルシャフト１２の先端部がシャフトの他の部分よりも柔らかいことが要望されている場合には、使用可能な適切なナイロンは、Ｅｌｆ ＡｔｏｃｈｅｍによるＰＥＢＡ ６３Ｄである。この材料は、最小８１００ｐｓｉの引張強度（ＡＳＴＭ Ｄ－６３８）、最小３００％の伸び（ＡＳＴＭ Ｄ－６３８）、最小４９，０００ｐｓｉのたわみ率（ＡＳＴＭ Ｄ－７９０）、６３Ｄ±４Ｄのデュロメーター（ＡＳＴＭ Ｄ－２２４０）、および、１６０℃～１８０℃の融点（ＡＳＴＭ Ｄ－３４１８）を有している。

【００３４】所望数の管腔を備えたカテーテルシャフト１２は、従来の押出工程により製作することができる。カテーテルシャフト１２の拡径部を形成するために、従来技術において知られているように、バンプ押出工程を使用することができる。管腔付きの一体型カテーテルシャフト１２に代えて、互いに接続された個別の複数のチューブを使用することができる。

【００３５】弾性チップ９６は、カテーテルシャフト１２の先端上にチップ材料の小チューブを配置し、そして、所定位置に熱接着することにより、カテーテルシャフトに対して取り付けることができる。同様に、接着剤を使用することができる。チューブ材料は、カテーテルシャフト１２の増大させてしまう。チップ材料のチューブの配置後に、カテーテルシャフト１２の外径を約０．０５６インチ（１．４２ｍｍ）よりも小さく維持するために、カテーテルシャフトの先端部と、チップ材料の取付に先立って、適切な量だけ、減少させるあるいは”すぼめる（necked-down）”ことができる。管腔１４、１６を開口状態に維持したままで、弾性チップを熱接着により取り付けるために、各管腔内には、心棒が挿入される。チップ材料のチューブは、カテーテルシャフト１２のうちの先端閉塞バルーン２２が取り付けられている領域にまで、延出することができる。この場合には、バルーン２２の全部または一部が、チップ材料に対して取り付けることができる。

【００３６】チップ材料の熱接着時には、第３管腔１８および第４管腔２０の先端部は、閉塞している。どちらかの管腔のより多くの部分を閉塞することが必要な場合には、カテーテルシャフト１２と同じ材料製の小さな閉体チューブが、その管腔の基端内に挿入され、その後、所定位置に熱接着される。接着剤を、同様に、使用することができる。チューブの外径は、前記管腔の直径よりもわずかに大きいことが好ましい。心棒は、他の管腔を開放状態に維持する。弾性チップ９６の取付時に第３管

腔１８が閉塞されない場合には、第４管腔と同様にして閉塞することができる。

【００３７】第１管腔１４および第２管腔１６の基端部は、同様にしてシールすることができる。

【００３８】閉塞バルーン２２、２４は、ナイロン、ポリアミド、ポリアミドコポリマー、ポリエチレン、ポリエチレンテレフタレート、ポリエステルエラストマー、ポリウレタン、カプトン（Ｋｒａｔｏｎ）、シリコーン、ラテックス、あるいは、任意の他の柔軟な非トロンボゲン形成材料から形成することができる。閉塞バルーン２２、２４は、膨らまされたときに、血管壁を膨らまさないものの、血管壁をシールする。バルーンは、膨張によって膨らむチューブとすることができ、あるいは、ブロー成形されたバルーンとすることができる。バルーン材料がカテーテルシャフト１２に対して適合性を有している場合には、閉塞バルーン２２、２４は、レーザー接着を含む熱接着技術により、取り付けることができる。カテーテル上にバルーンをレーザー接着するための装置および方法は、米国特許第５，２６７，９５９号に開示されている。この文献は、参考のためここに組み込まれる。接着剤を、同様に使用することができる。閉塞バルーン２２、２４として使用可能なナイロンは、ＥＭＳ－Ｃｈｅｍｉｅ　ＡＧによるＬ２５Ｇ　Ｇｒｉｌａｍｉｄである。この材料は、１７８℃の融点、１．０１ｋｇ／ｄｍ^{3}の密度（ＤＩＮ　５３４７９）、４０Ｎ／ｍｍ^{2}の引張強度（ＤＩＮ　５３４５５）、１０％の破裂における伸び（ＤＩＮ　５３４５５）、および、７２のショア（Ｓｈｏｒｅ）Ｄ硬度（ＤＩＮ　５３５０５）を有している。

【００３９】本発明の第１実施形態による薬剤搬送用カテーテルは、通常の方法により膨張が達成された後に、ＰＴＡ法またはＰＴＣＡ法による処置部位にまで、薬剤を搬送するために使用することができる。膨張カテーテルは、好ましくは、例えば、Ｂｏｎｚｅｌ氏の米国特許第４，７６２，１２９号に開示されているような迅速交換フォーマットからなるものである。この文献は、参考のためここに組み込まれる。このようなカテーテルが、まず最初に、取り外される。本発明の薬剤搬送用カテーテル１０が、その後、血管系内に導入され、前記膨張カテーテルを狭窄部位にまで案内した同一のガイドワイヤに沿って、ガイディングカテーテルを介して、膨張部位にまで進められる。交換ワイヤは、一切必要ではなく、ガイドワイヤは、身体から約７５ｃｍだけ突出するだけで済む。カテーテル１０の第１管腔１４の先端が、図１に示すガイドワイヤ２８のようなガイドワイヤ内に挿入される。カテーテルがガイドワイヤに沿って進むときには、ガイドワイヤは、カテーテル１０の開口３０から出ている。カテーテル１０は、膨張部位にまで前進される時には、ガイドワイヤのうちの第１管腔１４内に位置する部分に沿って搬送され続ける。

【００４０】カテーテル１０の進み具合は、Ｘ線透視法により追跡される。膨張部位に到達したときには、閉塞バルーン２２、２４が動脈壁に当接して動脈壁をシールするまで、第３管腔１８を通して膨らまされる。灌流用開口３２および３０ａが存在する場合には、それぞれ、第２管腔１６および第１管腔１４を通して流れ、カテーテル１０の先端部から流出する。カテーテル１０が能動灌流を行い得るよう構成されている場合には（すなわち、第２管腔１６がカテーテルシャフト１２の長さ全体にわたって延在している場合には）、血液またはＰｌｕｏｓｏｌ（登録商標）のような過フッ素化合物および再結合性ヘモグロビンを、従来技術において知られているように、チューブ７６を介してシリンジにより注入することができる。

【００４１】抗血栓崩壊剤、抗増殖剤、あるいは任意の他のタイプの薬剤は、ここで、シリンジにより、チューブ７２、第４管腔２０、さらには薬剤搬送用ポート３６を通して注入することができる。有効な薬剤の１つの形態は、実質的に１００ミクロンよりも小さな直径のポリ乳酸／ポリグリコール酸粒子に吸着させたデキサメタゾンである。このような粒子は、動脈壁に吸着する、あるいは、動脈壁を貫通することができる。粒子表面は、動脈壁に対する粒子の吸着力を高めるために、セル吸着性タンパク質により処理することができる。使用可能なアルギニングリシンアスパラギン酸に基づくペプチドは、Ｔｅｌｉｏｓ　Ｐｈａｒｍａｃｅｕｔｉｃａｌｓ，　Ｉｎｃ．によるＰｅｐｔｉｔｅ　２０００（登録商標）である。

【００４２】所望の圧力で、所望の時間（典型的には、約２０秒～３分）にわたって、薬剤が適用された後に、閉塞バルーンは、すぼまされ、薬剤搬送用カテーテル１０は、血管から迅速にかつ容易に引き抜かれる。

【００４３】図７は、本発明の第２実施形態の先端部を平面と断面とで示す図であって、拡張と薬剤搬送との両方を行い得るカテーテル１００が示されている。カテーテル１００は、第１管腔１１２、第２管腔１１４、第３管腔１１６、および第４管腔１１８を有するカテーテルシャフト１１０を備えている。カテーテルシャフト１１０には、膨張バルーン１２０、および、２つの閉塞バルーン１２２、１２４が、取り付けられている。膨張バルーン１２０は、開口１２６を通して第１管腔１１２と流体の連通が可能とされている。両閉塞バルーンは、同様に、開口１２８を通して第４管腔１１８と流体の連通が可能とされている。第２管腔１１４には、カテーテルシャフト１１０の壁を貫通してポート１３０が設けられており、このポート１３０を通して、膨張部位に対する薬剤投与を行うことができる。上記と同様にして、付加的な薬剤搬送用管腔を設けることができる。付加的な管腔は、膨張バルーン１２０に対して、あるいは同様に閉塞バルーン１２２、１２４に対して、流体を提供すること

ができる。また、第３管腔１１６には、カテーテルシャフト１１０の壁を貫通して、開口１３２が設けられている。カテーテル１００の先端１３４における開口１３３を貫通して延在している第３管腔１１６は、開口１３２を通してこの管腔１１６内に存在しているガイドワイヤ１３６を収容している。付加的な管腔（図示せず）を、また、能動的なあるいは受動的な灌流のために設けても良い。そのような灌流用管腔の先端は、上述のように、好ましくはテーパ形状とされている。上述のような滑りコーティングが、膨張バルーン１２０に、および、カテーテル１００の残りの部分に、適用される。上述のように、複数の管腔を有する一体型のカテーテルシャフトに代えて、カテーテルシャフト１１０を、互いに適切に結合された複数のチューブから構成することができる。

【００４４】膨張バルーン１２０は、ＰＴＡ法およびＰＴＣＡ法にとって適切な任意のタイプおよびサイズのものとすることができる。例えば、バルーン１２０は、ポリエチレン、ポリエチレンテレフタレート、ナイロン、ポリアミド、ポリアミドコポリマー、ポリウレタン、あるいは、膨張バルーンとして適切な他の任意の材料から形成することができる。バルーン１２０は、柔軟、非柔軟、あるいは、半柔軟とすることができる。膨張バルーン１２０は、従来技術において知られているように、レーザー接着あるいは超音波接着を含む熱接着により、または接着剤により、カテーテルシャフト１１０に対して取り付けることができる。バルーン１２０は、熱接着が可能であるように、カテーテルシャフト１１０と同じ材料であるか、または適合性のある材料であることが好ましい。

【００４５】膨張バルーン１２０として使用可能な低密度ポリエチレンは、ＲｅｘｅｎｅＣｏｒｐｏｒａｔｉｏｎによるＰ．Ｅ．１０３１である。この材料は、１９０±０．２℃において０．４～１．４ｇ／１０ｍｉｎのメルトフローインデックス（ＡＳＴＭ　Ｄ－１２３８）、０．９３±０．０２ｇ／ｃｃの密度（ＡＳＴＭ　Ｄ－１５０５）、および、１０４～１４０℃の融点（ＡＳＴＭ　Ｄ－３４１７、Ｄ－３４１８）を有している。使用可能な線形低密度ポリエチレンは、Ｄｏｗ　Ｃｈｅｍｉｃａｌ　Ｃｏｒｐｏｒａｔｉｏｎによる Ｄｏｗｌｅｘ２２４７Ａ　ＬＬＰＤＥである。この材料は、１９０℃／２．１６ｋｇにおいて２．０～２．６ｇ／１０ｍｉｎのメルトインデックス（ＡＳＴＭ　Ｄ－１２３８）、０．９１５０～０．９１９０ｇ／ｃｃの密度（ＡＳＴＭ　Ｄ－１５０５）、および、１２２～１２５℃の融点（Ｄ－３４１７、Ｄ－３４１８（ＲＥＦ））を有している。

【００４６】第１実施形態に関連して上述した材料は、本実施形態における他の対応する部材にとって適切である。第１実施形態と同様に、カテーテルシャフト１１０には、膨張バルーン１２０の下に、また、閉塞バルーン１２２、１２４の下に、放射線不透明マーカー１３８が設けられる。カテーテル１００の基端の構造は、図１に示すカテーテル１０の基端と本質的に同じである。ただし、カテーテルシャフト１１０の基端には、第１管腔１１２を通して膨張バルーン１２０へと膨張用流体を供給するための第３チューブが取り付けられる点だけが相違する。従来技術において知られているように、Ｙアダプターを、また、使用することができる。

【００４７】使用時には、本実施形態のカテーテル１００は、従来技術において知られているように、ガイディングカテーテルにより狭窄部位にまで既に進められたガイドワイヤ１３６のようなガイドワイヤに、挿入される。カテーテル１００内に開口１３４を通して侵入し、第３管腔１１６からは開口１３２を通して出ている。上述のように、カテーテル１００の一部だけがガイドワイヤと摩擦係合していることにより、カテーテルは、狭窄箇所へと容易にかつ迅速に進むことができるとともに、使用するガイドワイヤが短くて済む。適正に配置されたときには、膨張バルーン１２０は、従来方法により、狭窄部位を開放するために、膨らむことができる。その後、膨張バルーン１２０をすぼませて、上述のように、閉塞バルーン１２２、１２４を膨らませることができる。任意の所望の薬剤は、その後に、第２管腔１１４を通して供給することができる。同一のカテーテルでもって拡張と薬剤搬送との両方を行い得ることにより、本実施形態においては、膨張用カテーテルを引き抜いてさらに別体の薬剤搬送用カテーテルを挿入するのに必要な時間を省くことができ、手術時間を短縮することができる。加えて、本実施形態においては、薬剤搬送用カテーテルの適正配置のための、膨張部位への正確な再配置という問題を緩和することができる。

【００４８】本発明の第３実施形態においては、カテーテル２００は、同一の膨張バルーンでもって、狭窄部位の拡張と拡張箇所への薬剤搬送との両方を行うことができる。図８は、このようなカテーテル２００の先端部を平面と断面とで示す図であって、膨張バルーンが膨張した状態が示されている。カテーテル２００は、カテーテルシャフト２１０、第１管腔２１２、第２管腔２１４、および、第３管腔２１６を備えている。第２管腔２１４は、開口２１９を通してガイドワイヤ２１８を収容している。第２管腔２１４には、ガイドワイヤ２１８の出口を形成するために、カテーテルシャフト２１０を貫通して、開口２１７が設けられている。複数の管腔を有する一体型のカテーテルシャフトに代えて、カテーテルシャフト２１０は、また、互いに適切に結合された複数のチューブから構成することができる。

【００４９】カテーテル２００のバルーン部は、外バルーン２２０および内バルーン２３０を備えている。第２管腔２１４は、内バルーン２３０の内部を挿通して延在している。外バルーン２２０の先端は、内バルーン２３０の先端に対して、熱または接着剤により接着されてい

る。一方、内バルーン２３０の先端は、第２管腔２１４の外表面に対して、場所２４０において、熱または接着剤により接着されている。外バルーン２２０および内バルーン２３０の両基端は、カテーテルシャフト２１０に対して、外バルーンと内バルーンとの中間の領域が第１管腔２１２と流体連通している状態で、かつ、内バルーン２３０の内部が第３管腔２１６と流体連通している状態で、熱または接着剤により接着されている。膨張用流体は、第３管腔２１６を通して供給され、薬剤は、第１管腔２１２を通して供給される。複数の微小孔２８０が、薬剤をバルーンから放出するために、外バルーン２２０の壁を貫通して形成されている。このような孔は、０．０１ミクロン～０．１ｍｍとすることができる。バルーン２２０の外層が、ポリエチレンテレフタレートあるいはナイロンあるいはポリエステルエラストマーのような二軸配向プラスチック材料を備えている場合には、微小孔２８０は、精度の高いレーザーを使用して形成することができる。

【００５０】使用時には、ガイドワイヤ２１８が、従来方法によりガイドカテーテルを介して、処置されるべき障害部位へと進められる。第２管腔２１４の先端が、ガイドワイヤ２１８の基端部にわたって取り付けられる。上記両実施形態と同様に、ガイドワイヤは、カテーテル２００から開口２１７を通して出ている。カテーテル２００は、バルーン部が処置されるべき障害部位に到達するまで、ガイドワイヤのうちの第２管腔２１４内の部分に沿って前進を続ける。図８においては、バルーン部の内層２３０および外層２２０が膨張状態で図示されているけれども、これら層は、狭窄部位へと前進する際には、管腔２１４の外面に対して密着した状態となっている。

【００５１】放射線不透明マーカーバンド２４２を利用して、カテーテル２００の先端部が適切に配置されると、選択された薬剤が、第１管腔２１２を通して、外バルーン２２０・内バルーン２３０の中間領域に、導入される。薬剤の注入は、外バルーン２２０のいくらかの拡張をもたらすけれども、典型的には、薬剤が注入されるような圧力は、薬剤の量が実質的に微小孔２８０から放出されてしまうような圧力よりも小さい。薬剤搬送と拡張との両方を同時に行うために、次に、膨張用流体が、第３管腔２１６を通して、内バルーン２３０の内部へと、注入される。圧力が増加すると、典型的には７～８気圧に到達すると、バルーンの内層２３０は、所定最大直径にまで膨らむ。そして、このように膨らむことにより、特別の薬剤でもって処置されている障害部位に対して、ポート２８０を通して、薬剤を効果的に散布することができる。内バルーン２３０の膨張により、また、障害部位に対して作用する圧力がもたらされ、薬剤が適用しながら血管壁に対する押し付けを行うことができる。

【００５２】本発明の薬剤搬送用カテーテルによる膨張部位に対しての薬剤の搬送のためのバルーンの使用は、図９の第４実施形態に示されている。カテーテル３００は、上述のように、カテーテルシャフト３１０に対して、熱または接着剤により取り付けられた薬剤搬送用バルーン３１２を備えている。図９においては、バルーン３１２は、膨張状態で示されている。複数の薬剤搬送用ポート３１４が、バルーン３１２にわたって設けられている。バルーン３１２は、カテーテルシャフト３１０の壁を貫通するポート３１８を通して、薬剤搬送用管腔３１６と流体連通している。付加的な薬剤搬送用管腔を、また、設けることができる。ガイドワイヤ用管腔３２０は、先端３２２を貫通して、カテーテルシャフト３１０の先端部に設けられている。ガイドワイヤ用管腔３２０は、カテーテルシャフト３１０の先端部のうちの、薬剤搬送用バルーン３１２の基端側において、終端している。カテーテルシャフト３１０の壁には、ガイドワイヤ用管腔３２０に連通する開口３２４が設けられている。ガイドワイヤ３２６は、カテーテルシャフト３１０の先端３２２において開口３２８を通して挿入することができ、また、開口３２４を通して出すことができる。

【００５３】テーパ状端部３３０ａが形成された灌流用管腔３３０を、設けることが好ましい。この管腔は、上述のように、能動灌流を可能とするように、カテーテルシャフト３１０の長さ全体にわたって延在することができる。これに代えて、この管腔は、薬剤搬送用バルーン３１２の基端側において終端することができる。その場合、能動灌流を可能とするために、第１実施形態と同様にして、複数の開口（図示せず）を、カテーテルシャフト３１０の壁を貫通して設けることができる。複数の管腔を備えた一体型のカテーテルシャフトに代えて、カテーテルシャフト３１０を、互いに適切に接着された複数のチューブから構成することができる。

【００５４】本願発明の第５実施形態は、バルーン拡張型ステントに、空間膨張機能と局所的薬剤搬送機能とを組み合わせたものである。図１０、１１、および、図１２、１３には、それぞれ、非膨張状態および膨張状態を示している。カテーテル４００は、上述と同様にしてカテーテルシャフト４０１に融着されたまたは接着された二重壁型の膨張用かつ薬剤搬送用のバルーン４１２と、第１管腔４０５と、第２管腔４０６と、第３管腔４０７と、を備えている。第２管腔４０６は、開口４１９を通してガイドワイヤ４１８を受領している。第２管腔４０６に対して、カテーテルシャフト４０１を貫通して、開口４１７が設けられている。この開口４１７は、ガイドワイヤ４１８のための出口をなすことができる。複数の管腔が設けられている一体型のカテーテルシャフトに代えて、カテーテルシャフト４０１は、また、互いに接着された複数のチューブから構成することもできる。

【００５５】二重壁バルーン４１２は、本発明の第３実施形態における二重壁バルーンと同様のものである。バ

ルーン膨張可能ステント４４０が、二重壁バルーンに取り付けられている。取付方法は、係合や、バルーン膨張かつステント配置時に二重壁バルーンからステントを取外し得るような他の任意の方法によって行うことができる。

【００５６】使用時には、ガイドワイヤ４１８が、従来方法によりガイドカテーテルを介して、処置されるべき障害部位へと進められる。第２管腔４０６の先端４１９が、ガイドワイヤ４１８の基端部にわたって取り付けられる。上記両実施形態と同様に、ガイドワイヤは、カテーテル４００から開口４１７を通して出ている。カテーテル４００は、バルーン部が処置されるべき障害部位に到達するまで、ガイドワイヤのうちの第２管腔４０６内の部分に沿って前進を続ける。図１０～図１３においては、バルーン部の内層４３０および外層４２０が膨張状態で図示されているけれども、これら層は、狭窄部位へと前進する際には、管腔４１９の外面に対して密着した状態となっている。

【００５７】放射線不透明マーカーバンド４４２を利用して、カテーテル４００の先端部が適切に配置されると、選択された薬剤が、第３管腔４０７を通して、外バルーン４３０・内バルーン４２０の中間領域に、導入される。薬剤の注入は、外バルーン４３０のいくらかの拡張をもたらすけれども、典型的には、薬剤が注入されるような圧力は、薬剤の量が実質的に微小孔４２８から放出されてしまうような圧力よりも小さい。薬剤搬送と狭窄の拡張とステントの配置とを同時に行うために、次に、膨張用流体が、第１管腔４０５を通して、内バルーンの内部４２１へと、注入される。圧力が増加すると、典型的には７～８気圧に到達すると、バルーンの内層４２０は、所定最大直径にまで膨らむ。そして、このように膨らむことにより、特別の薬剤でもって処置されている障害部位に対して、薬剤を効果的に散布することができるとともに、ステントを膨張させて血管壁に対してステントを押しつけることができる。薬剤は、外バルーンの孔から放出されて、ステントの格子を通して浸透していく。

【００５８】本発明による薬剤搬送用カテーテルおよび膨張型薬剤搬送用カテーテルにおいては、迅速かつ容易なカテーテルの前進および引抜が可能であり、よって、手術に要する時間を短縮することができる。また、必要な人員および装置を省略することができ、手術コストを低減することができる。

【００５９】上記においては、本発明の好ましい実施形態について説明してきたけれども、上記実施形態は、本発明の範囲を制限するものではなく、本発明の範囲は、請求の範囲によって定義されている。

【図面の簡単な説明】

【図１】　本発明の一実施形態による薬剤搬送用カテーテルを示す図であって、カテーテルの先端部については、拡大して断面で図示されている。

【図２】　図１に示すカテーテルの先端部を、図１の２－２線に沿って示す断面図である。

【図３】　図１に示すカテーテルの先端部を、９０°回転して示す断面図である。

【図４】　図３に示すカテーテルの先端部を、図３の４－４線に沿って示す断面図である。

【図５】　図１に示すカテーテルの基端部を、図１の５－５線に沿って示す断面図である。

【図６】　図３に示すカテーテルを、膨張した閉塞バルーンとともに示す平面図である。

【図７】　本発明の第２実施形態の先端部を、平面と断面とで示す図である。

【図８】　本発明の第３実施形態の先端部を、平面と断面とで示す図である。

【図９】　本発明の第４実施形態を、平面と断面とで示す図である。

【図１０】　本発明の第５実施形態を示す図である。

【図１１】　本発明の第５実施形態を示す図である。

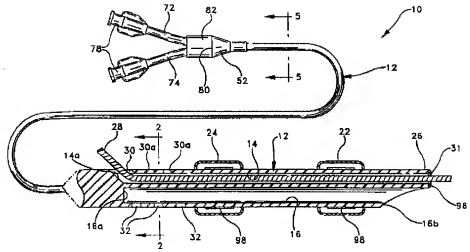
【図１２】　本発明の第５実施形態を示す図である。

【図１３】　本発明の第５実施形態を示す図である。

【符号の説明】

４００　カテーテル
４０１　カテーテルシャフト
４０５　管腔
４０６　管腔
４０７　管腔
４１２　バルーン
４１７　第２開口
４１８　ガイドワイヤ
４１９　先端
４２０　内層
４２８　（薬剤放出のための）開口
４３０　外層
４４０　ステント

【図1】



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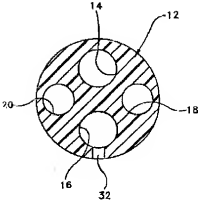

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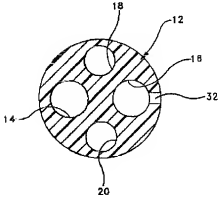

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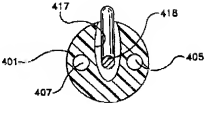

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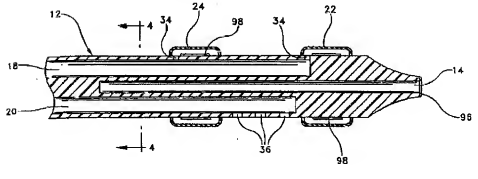

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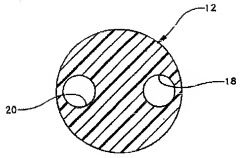
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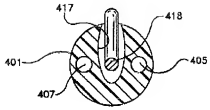
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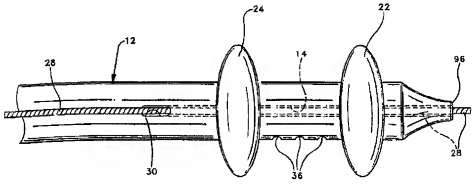
【図6】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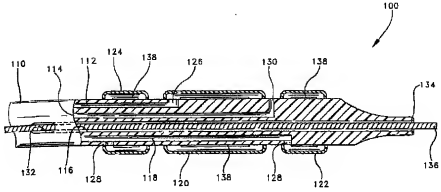
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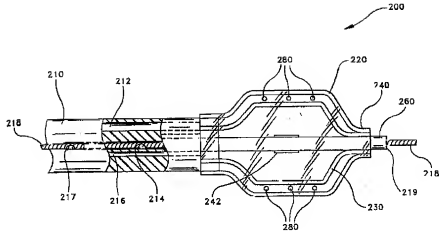
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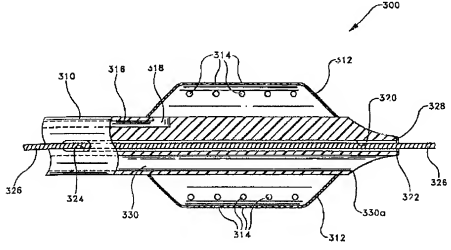
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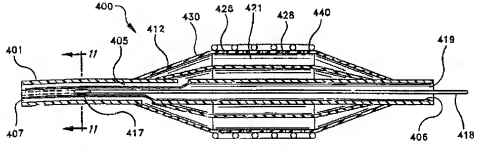
【図10】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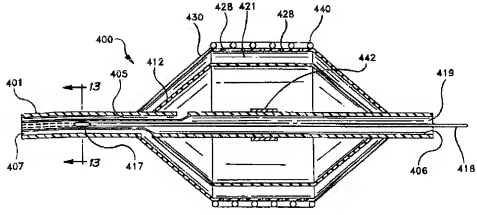
【図12】



* NOTICES *

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3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1]It is a catheter for stent deployment type drugs conveyance characterized by comprising the following, While being the 1st catheter shaft provided with at least one lumen (114) for drugs conveyance for supplying drugs to at least one port (130) for drugs conveyance in which it is located near a tip and this tip, and this port (130) for drugs conveyance, it is inside of this 1st catheter shaft.
From said tip (134), The 1st catheter shaft provided with a lumen (116) for guidewires which migrates even to a terminal point which is forming an opening (132) for being located in the end face side rather than said port (130) for drugs conveyance, and making a guidewire (136) take out from said 1st catheter shaft, and extends.
The 2nd catheter shaft (110) that is a lumen which extends over a end face, a tip, and these end faces and a tip, and was provided with a lumen for receiving said 1st catheter shaft.
It provides and is a stent deployment means (120) at said tip of said 2nd catheter shaft.

[Claim 2]The catheter for stent deployment type drugs conveyance according to claim 1 characterized by comprising the following.
The 1st blockade balloon (122) in which said 2nd catheter shaft (110) is further located in the tip side rather than said port (130) for drugs conveyance.
A lumen (118) for expansion which circulation of a fluid is opening for free passage possible to this 1st blockade balloon (122).

[Claim 3]Said 2nd catheter shaft is further provided with the 2nd blockade balloon (124) located in the end face side rather than said port (130) for drugs conveyance, The catheter for stent deployment type drugs conveyance according to claim 2, wherein said terminal point of said lumen (116) for guidewires is located in the end face side rather than said 2nd blockade

balloon (124).
[Claim 4]The catheter for stent deployment type drugs conveyance according to claim 3, wherein circulation of a fluid is opening said lumen (118) for expansion for free passage possible to said 1st blockade balloon (122) and said 2nd blockade balloon (124).
[Claim 5]The catheter for stent deployment type drugs conveyance according to claim 1, wherein two or more ports (130) for drugs conveyance which circulation of a fluid is opening for free passage possible to said lumen (114) for drugs conveyance are provided.
[Claim 6]The catheter for stent deployment type drugs conveyance according to claim 3, wherein said blockade balloon (122, 124) is provided with a plastic tube which can expand.
[Claim 7]The catheter for stent deployment type drugs conveyance according to claim 3, wherein blow molding of said blockade balloon (122, 124) is carried out.
[Claim 8]The catheter for stent deployment type drugs conveyance according to claim 2 provided with an inflow means for enabling blood circulation which lets said at least a part of 1st catheter shaft pass.
[Claim 9]The catheter for stent deployment type drugs conveyance according to claim 3 having an additional lumen in said 1st catheter shaft for inflow.
[Claim 10]The catheter for stent deployment type drugs conveyance according to claim 9 having at least one opening which circulation of a fluid is opening for free passage possible to said additional lumen to the end face side rather than said blockade balloon (122, 124) in a wall of said 1st catheter shaft.
[Claim 11]The catheter for stent deployment type drugs conveyance according to claim 1 characterized by comprising the following.
An inflation balloon (120) provided on said 2nd catheter shaft.
A lumen (112) for expansion provided in said 1st catheter shaft as circulation of a fluid was open for free passage possible to this inflation balloon (120).

[Claim 12]An inflation balloon (120) provided on said 2nd catheter shaft, A lumen (112) for expansion provided in said 1st catheter shaft as circulation of a fluid was open for free passage possible to this inflation balloon (120), The catheter for stent deployment type drugs conveyance according to claim 3, wherein a preparation and said inflation balloon (120) are arranged among said blockade balloons (122, 124).
[Claim 13]The catheter for stent deployment type drugs conveyance according to claim 9, wherein said additional lumen has a tapered shape tip.
[Claim 14]a tip part and a tip (134) -- and, A stent deployment means (120) attached to said tip part of a catheter shaft (110) which has a end face, and; this catheter shaft (110); As opposed to said catheter shaft (110). The 1st blockade balloon (122) attached to the tip side position rather than said stent deployment means (120); The 2nd blockade balloon (124) and; which

were attached to the end face side position rather than said stent deployment means (120) to said catheter shaft (110) are provided, Further in at least one [said stent deployment means (120) and] between of said blockade balloons (122, 124) said catheter shaft (110), At least one port (130) for drugs conveyance established in said tip part of said catheter shaft (110), at least one which circulation of a fluid opened for free passage possible to said balloon for a blockade (122, 124) -- swelling -- business -- with a lumen (118) and at least one lumen (114) for drugs conveyance which circulation of a fluid opened for free passage possible to said port (130) for drugs conveyance. Have a lumen (116) for guidewires provided in said tip part of said catheter shaft (110), and said lumen (116) for guidewires, The 1st opening that carries out an opening to the exterior of said catheter shaft (110) in said tip (134) of said catheter shaft (110), It reaches, In said tip part which is a end face side and is located in the tip side more nearly substantially than said base end of said catheter shaft (110) rather than said 2nd blockade balloon (124) of said catheter shafts (110). Have the 2nd opening (132) that carries out an opening to the exterior of said catheter shaft (110), and by this a guidewire (136), A catheter for stent deployment type drugs conveyance being able to enter in said catheter shaft (110) through said 1st opening, and being able to come out of said catheter shaft through said 2nd opening (132).

[Claim 15]The catheter for stent deployment type drugs conveyance according to claim 14, wherein said catheter shaft (110) is really a thing.

[Claim 16]A catheter for stent deployment type drugs conveyance characterized by comprising the following.

An inflation balloon (412) and; which were attached to said tip part of a catheter shaft (401) provided with a tip part, a tip, and a end face and; this catheter shaft are provided, Have said inflation balloon and an outer layer (430) and a inner layer (420) said inner layer (420), Form an interior area near [said] the catheter shaft (401), and said outer layer (430) and a inner layer (420), The 1st lumen in which an external area is formed, said outer layer (430) has two or more openings (428), and circulation of a fluid opened said catheter shaft (401) for free passage possible to said outside area further.

The 2nd lumen that circulation of a fluid opened for free passage possible to said inner area.

The 3rd lumen provided in said tip part of said catheter shaft in order to accommodate a guidewire (418).

The 1st opening that carries out the opening of a preparation and said 3rd lumen to the exterior of said catheter shaft (401) in said tip (419) of said catheter shaft (401), It reaches, In said tip part which is a end face side and is located in the tip side more nearly substantially than said base end of said catheter shaft (401) rather than said inflation balloon (412) of said catheter shafts (401). Have the 2nd opening (417) that carries out an opening to the exterior of said catheter shaft (401), and by this said guidewire (418), It can enter in said catheter shaft

through said 1st opening, and can come out of said catheter shaft through said 2nd opening (417), and is a stent deployment means (412) in said tip part of said catheter shaft (401).

[Claim 17]The catheter for stent deployment type drugs conveyance according to claim 16, wherein said 1st lumen is constituted so that drugs can be conveyed, and said 2nd lumen is constituted so that a fluid for expansion can be conveyed.

[Claim 18]A balloon (412) for drugs conveyance and; which were attached to said tip part of a catheter shaft (401) provided with a tip part, a tip, and a end face and; this catheter shaft (401) are provided, Have said balloon (412) for drugs conveyance, and two or more ports (428) which penetrate this balloon and extend said catheter shaft (401), At least one lumen for conveyance which circulation of a fluid opened for free passage possible to said balloon (412) for drugs conveyance, And in order to accommodate a guidewire (418), have a lumen (406) provided in said tip part of said catheter shaft, and this lumen (406), The 1st opening that carries out an opening to the exterior of said catheter shaft in said tip (419) of said catheter shaft (401), It reaches, In said tip part which is a end face side and is located in the tip side more nearly substantially than said end face of said catheter shaft (401) rather than said balloon (412) for drugs conveyance of said catheter shafts (401). Have the 2nd opening (417) that carries out an opening to the exterior of said catheter shaft (401), and by this said guidewire (418), It can enter in said catheter shaft (401) through said 1st opening, A catheter for stent deployment type drugs conveyance, wherein it can come out of said catheter shaft (401) through said 2nd opening and a stent deployment means (412) is formed in said tip part of said catheter shaft (401).

[Claim 19]The catheter for stent deployment type drugs conveyance possessing a lumen for inflow according to claim 18.

[Claim 20]The catheter for stent deployment type drugs conveyance according to claim 19, wherein it went over said lumen for inflow and it has extended by said end face of said catheter shaft (401) from said tip of said catheter shaft (401).

[Claim 21]Said lumen for inflow from said tip (419) of said catheter shaft (401), Migrate even to a terminal point by the side of a end face, have extended rather than said balloon (412) for drugs conveyance, and said catheter shaft (401), While being located near [said] the terminal point of said lumen for inflow, so that blood can enter in said lumen for inflow, The catheter for stent deployment type drugs conveyance according to claim 19 provided with at least one port which penetrates said catheter shaft (401) and extends so that it may be open for free passage to said lumen for inflow.

[Claim 22]The catheter for stent deployment type drugs conveyance according to claim 21, wherein said lumen for inflow has a tapered shape tip.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the catheter for balloon expansion type drugs conveyance, and the catheter for stent deployment type drugs conveyance, and is provided with the lumen for guidewires which carries out a termination into a catheter shaft, and the opening for taking out a guidewire from a catheter shaft.
[0002]
[Description of the Prior Art]A percutaneous transluminal arterioplasty ("PTA") and the percutaneous transluminal coronary-arteries plasty ("PTCA") expand an inflation balloon, in order to carry forward an inflation balloon to a strangulation part through a blood circulatory system and to open a barrier, and they are the usual method of operation nowadays. However, in about 1/3 of such an operation, the restenosis occurs and the further extended operation is needed.
[0003]Various drugs which may reduce the restenosis are applicable to a strangulation part. For example, an anti-thrombolysis agent like heparin can prevent a blockade. The thrombogen formation can cause various phenomena which may bring about the restenosis. An anti-growth agent like dexamethasone can prevent movement and growth of smooth muscle cells.
[0004]Various methods are proposed in order to convey such drugs effectively to an extended part. For example, the catheter which equipped Mr. Wolinsky's U.S. Pat. No. 5,087,244 with the light-gage flexible balloon in which two or more stomata were formed is indicated. After completion of an angioplasty, such a balloon is carried forward to an extended part, and expands with heparin or other drugs. Drugs let a stoma pass and are emitted from the inflation balloon in contact with an arterial wall.
[0005]The catheter provided with the conduit tube for drugs conveyance is indicated by Mr. Wolinsky's U.S. Pat. No. 4,824,436 and U.S. Pat. No. 4,636,195. The conduit tube for drugs

conveyance is provided among the blockade balloons of a couple. The embodiment by which the inflation balloon which makes possible the both sides of the expansion which uses the same catheter, and drugs conveyance was provided among the blockade balloons of a couple is indicated.

[0006]Other objects for expansion and the catheter for drugs conveyance are indicated by U.S. Pat. No. 4,994,033 of Shockey Mr. others. In this case, the double layer balloon in which two or more stomata were formed in the outer layer is provided. Drugs are introduced between two layers and the fluid for expansion is introduced into the inside of a balloon. While strangulation expands, drugs are directly applied to the extended organization by the pressure of the fluid for expansion.

[0007]

[Problem(s) to be Solved by the Invention]Typically, the object for drugs conveyance and the catheter for expansion are carried forward even to an extended part along with the guidewire accommodated in the lumen for guidewires which penetrated the whole shaft of the catheter and has extended. For the frictional force between a guidewire and a catheter, advance and removal of a catheter are difficult and time has required them.

[0008]In addition, when the whole catheter has covered the guidewire, to insert or exchange wires for a wrap catheter, the guidewire needs to project only length longer than the length of a catheter from the patient's body. The portion which length is about 300 cm and such a guidewire has in the outside of the body is about 230 cm. Otherwise, a guidewire cannot be fixed and arrangement [/ near the obstacle] cannot be maintained. It can replace with such a long guidewire and an exchange wire can be connected to the portion in the outside of the body of the guidewires at the time of exchange of a catheter. An exchange wire requires that length should be at least 180 cm. In the case of which, in order to deal with a long wire, at the time of operation, an additional operator is required. Even though an additional operator is needed, operation of the catheter at the time of exchange is inconvenient. Therefore, the length and expense of an operation will increase unnecessarily.

[0009]

[Means for Solving the Problem]At least one port for drugs conveyance in which it is located a tip and near this tip in an embodiment with this invention, And a catheter for drugs conveyance possessing a catheter shaft provided with at least one lumen for drugs conveyance for supplying drugs to this port for drugs conveyance is proposed. A catheter shaft is further provided with a lumen for guidewires which migrates even to a terminal point from a tip of a catheter shaft, and extends in a catheter shaft. A terminal point is arranged rather than a port for drugs conveyance at the end face side, and an opening for taking out a guidewire from a catheter shaft is formed near the terminal point. Therefore, a catheter shaft is only a wrap in a part of mere guidewire which extends over the outside of the body, and needs neither a long

guidewire nor an exchange wire. Preferably, a blockade balloon is provided in order to isolate a drugs transportation area. It is preferred that an additional lumen for inflow is provided. As for a tip of a lumen for inflow, being considered as tapered shape is preferred.

[0010]In other embodiments of this invention, a catheter for expanded type drugs conveyance possessing a catheter shaft provided with a tip part, a tip, and a end face is proposed. An inflation balloon is attached to a tip part of a catheter shaft. The 1st blockade balloon is attached to the tip side position rather than an inflation balloon to a catheter shaft, and the 2nd blockade balloon is attached to the end face side position rather than an inflation balloon to a catheter shaft. In between [at least one] of an inflation balloon and the blockade balloons, a catheter shaft equips a tip part of a catheter shaft with at least one port for drugs conveyance further. At least one lumen for expansion which circulation of a fluid opened for free passage possible to a balloon for expansion is provided. at least one which circulation of a fluid opened for free passage possible to a balloon for a blockade -- swelling -- business -- a lumen is provided. At least one lumen for drugs conveyance which circulation of a fluid opened for free passage possible to a port for drugs conveyance is provided similarly.

[0011]A lumen for guidewires is provided in a tip part of a catheter shaft. The 1st opening that carries out the opening of the lumen for guidewires to the exterior of a catheter shaft in a tip of a catheter shaft, And it has the 2nd opening that carries out an opening to the exterior of a catheter shaft in a tip part which is a end face side and is substantially located in the tip side rather than a base end of a catheter shaft rather than the 2nd blockade balloon of the catheter shafts. The guidewire can enter in a catheter shaft through the 1st opening, and can come out of a catheter shaft through the 2nd opening. As mentioned above, when the whole catheter shaft has not covered a guidewire, neither a long guidewire nor an exchange wire is required. A problem of a time lag for rearrangement and catheter displacement to a strangulation part after extension is avoided by the ability to carry out that it is also with the same catheter with both extension of a strangulation part, and drugs conveyance.

[0012]In embodiment of a catheter for expanded type drugs conveyance by this invention another again, an inflation balloon attached to a tip part of a catheter shaft has an outer layer and a inner layer. A inner layer forms an interior area near the catheter shaft, and an outer layer and a inner layer form an external area. An outer layer has two or more openings. Circulation of a fluid is opening the 1st lumen for free passage possible to an outside area, and circulation of a fluid is opening the 2nd lumen for free passage possible to an inner area. The 3rd lumen for accommodating a guidewire is provided in a tip part of a catheter shaft. The 1st opening that carries out the opening of the 3rd lumen to the exterior of a catheter shaft in a tip of a catheter shaft, And it has the 2nd opening that carries out an opening to the exterior of a catheter shaft in a tip part which is a end face side and is substantially located in the tip side rather than a base end of a catheter shaft rather than an inflation balloon of the catheter shafts.

The guidewire can enter in a catheter shaft through the 1st opening, and can come out of a catheter shaft through the 2nd opening.

[0013]In another embodiment of this invention, a balloon for drugs conveyance with two or more ports is attached to a tip part of a catheter shaft. A catheter shaft is provided with a lumen provided in a tip part of a catheter shaft in order to accommodate further at least one lumen for conveyance which circulation of a fluid opened for free passage possible to a balloon for drugs conveyance, and a guidewire. The 1st opening that carries out the opening of the lumen for guidewires to the exterior of a catheter shaft in a tip of a catheter shaft, And it has the 2nd opening that carries out an opening to the exterior of a catheter shaft in a tip part which is a end face side and is substantially located in the tip side rather than a base end of a catheter shaft rather than a balloon for drugs conveyance of the catheter shafts. Also in this case, the guidewire can enter in a catheter shaft through the 1st opening, and can come out of a catheter shaft through the 2nd opening. It is preferred that a lumen for inflow is provided. As for a lumen for inflow, it is preferred to have a tapered shape tip.

[0014]In further embodiment of this invention, a drugs transportation means is combined with both sides of space expansion and arrangement of stent which can be balloon expanded in the same catheter shaft.

[0015]

[Embodiment of the Invention]Drawing 1 is a figure showing the catheter for drugs conveyance by one embodiment of this invention, about the tip part of the catheter, is expanded and is illustrated in the section. Drawing 2 is a sectional view showing the tip part of the catheter shown in drawing 1 along two to 2 line of drawing 1. Drawing 3 is a sectional view in which 90 degrees' rotating and showing the tip part of the catheter shown in drawing 1. Drawing 4 is a sectional view showing the tip part of the catheter shown in drawing 3 along four to 4 line of drawing 3. Drawing 5 is a sectional view showing the base end of the catheter shown in drawing 1 along five to 5 line of drawing 1. Drawing 6 is a top view showing the catheter shown in drawing 3 with the blockade balloon which expanded. Drawing 7 is a figure showing the tip part of a 2nd embodiment of this invention in a flat surface and a section. Drawing 8 is a figure showing the tip part of a 3rd embodiment of this invention in a flat surface and a section. Drawing 9 is a figure showing a 4th embodiment of this invention in a flat surface and a section. Drawing 10 - drawing 13 are the figures showing a 5th embodiment of this invention.

[0016]Drawing 1 - drawing 6 show one embodiment of the catheter 10 for drugs conveyance by this invention. In drawing 1, the tip part of the catheter 10 is expanded and is shown by the section. The catheter 10 is provided with the catheter shaft 12. Preferably, the two blockade balloons 22 and 24 are attached to the tip part of the catheter shaft 12. The 1st lumen 14 that migrates even to the about 24 blockade balloon terminal point 14a from the tip 26 of the catheter shaft 12, and extends is formed so that the guidewire 28 may be received. The

opening 30 is formed in the wall of the catheter shaft 12 [near the terminal point 14a]. Preferably, the 1st lumen 14 is arranged near the edge part of the catheter shaft 12. The guidewire 28 can pass along the opening 31 in the tip part 26 of the catheter shaft 12, and can enter into the 1st lumen 14 of the catheter shaft 12, and can come out of the opening 30. Substantially, the opening 30 is located in the tip side of the base end of the catheter 10. The diameter of the 1st lumen can be about 0.022 inch (0.56 mm). At the time of use, the tip part of the guidewire 28 is projected from the tip of the lumen 14, as shown in drawing 1. As for the distance between the tip of a catheter, and the opening 30, it is preferred that it is about 5-25 cm. Although shorter longer or length is possible for the total length of the catheter 10 for drugs conveyance, it can be begun from 120-160 cm. It is not necessary to use too long a wire according to the guidewire 28 being able to come out of the catheter shaft 12 through the opening 30. It is not necessary to use an exchange wire. When removing from the body, a part of mere guidewire which extends over the outside of the body is because it is covered by the catheter 10. Therefore, when the catheter 10 of this invention is inserted into the body or is removed, sufficient allowance for being held in a prescribed position exists in a guidewire. In the catheter 10 by this invention, the guidewire 28 only projects about 75 cm from the body.

[0017]Preferably, the 2nd lumen 16 migrated even to the about 24 blockade balloon terminal point 16a from the tip 26 of the catheter shaft 12 again, and has extended. The diameter of the 2nd lumen can be about 0.013 inch (0.33 mm). Preferably, the wall of the catheter shaft 12 is penetrated and two or more ports 32 are formed so that it may be open for free passage to the 2nd lumen 16. Two or more ports 32 can enable active inflow of the blood which lets a lumen pass so that it may explain further below. It is preferred that the port 32 of circular or an ellipse form a diameter or whose length is 2-20 about 0.003-0.020 inch (0.076-0.51 mm) pieces, respectively is formed. The three openings 32 for inflow are formed in this embodiment. The port 30a which is open for free passage to the 1st lumen 14 for enabling similarly inflow of the blood which lets the 1st lumen 14 pass can be formed between the end face blockade balloon 24 and the opening 30. As for the tip 16b of the 2nd lumen 16, as shown in drawing 1, it is preferred that it is tapered shape. The opening in the tip 16b being able to become difficult to be seen, mistaking to the 1st lumen 14 by this, at the time of use, and inserting the guidewire 28 into the 2nd lumen 16 is prevented. Active inflow of the perfluorochemical known from blood or the former or recombination nature hemoglobin is enabled so that it replaces with such composition, and the lumen 16 may be made to extend covering the whole length of the catheter shaft 12 and this may explain it below.

[0018]Drawing 2 is a sectional view which meets two to 2 line of drawing 1, and shows the 3rd lumen 18 and the 4th lumen 20 to the 1st lumen 14 and the 2nd lumen 16, the port 32, and the pan. The 3rd lumen 18 and the 4th lumen 20 are explained with reference to drawing 3.

[0019]Drawing 3 is a sectional view in which 90 degrees' rotating and showing the tip part of

the catheter 10. The graphic display abbreviation of the guidewire 28 is carried out. The 3rd lumen 18 is shown in the figure. This 3rd lumen 18 is for letting the port 34 which penetrates the catheter shaft 12 pass to the blockade balloons 22 and 24, and supplying the fluid for expansion. Preferably, in order to blow up the both sides of the balloons 22 and 24, the single lumen 18 is used. The diameter of the 3rd lumen 18 can be set to about 0.010 (0.25 mm). Similarly, two or more lumina isolated to each balloons 22 and 24 can also be provided.

[0020]The 4th lumen 20 for conveying drugs is illustrated again. Among blockade balloons, at least one port 36 for drugs conveyance penetrates the catheter shaft 12, and it is provided so that it may be open for free passage to the 4th lumen 20. The diameter of the 4th lumen 20 can be set to about 0.010 (0.25 mm). In order to make conveyance of suitable drugs to an expansion part into a positive thing, it is preferred that the port 36 of circular or an ellipse form a diameter or whose length is 2-20 about 0.003-0.020 inch (0.076-0.51 mm) pieces, respectively is formed. In drawing 3, the number of such ports is three. The drugs of arbitrary requests can be conveyed by the 4th lumen 20 to an expansion part. Drawing 4 is a sectional view by four to 4 line of drawing 3 of the catheter shaft 12, and the arrangement situation of two or more lumina which can be set to drawing 3 is shown. The additional lumen for drugs conveyance can be provided.

[0021]As for the blockade balloons 22 and 24, at the time of drugs conveyance, it is preferred that an expansion part can be isolated. The blockade balloons 22 and 24 maintain drugs near [where it already swelled of the arterial walls] the portion. Thereby, absorption and validity of drugs improve. Drawing 6 is a top view of the catheter 10 of direction of drawing 3, and the blockade balloons 22 and 24 blown up at the time of drugs conveyance just before drugs conveyance are shown. The port 36 for drugs conveyance is also illustrated by the guidewire 28 and pan which have come out of the opening 30 and the opening 30. The opening 32 for inflow is located in the other side of a catheter in this figure.

[0022]It can replace with the integral-type catheter shaft 12 provided with two or more lumina, and the catheter shaft 12 can be provided with two or more tubes pasted up appropriately mutually. In addition, it can expand in drawing 6 and the tip part of the shown catheter shaft 12 can be formed from a material softer than other portions of a shaft. If formed from material with a soft tip part, the operativity which lets a blood circulatory system pass can be raised. On the other hand, pushing nature can be made good if the remaining portion of the shaft is formed from a harder material. These two portions can only be combined with heat adhesion or adhesives which is known in conventional technology. A suitable material is mentioned later. the wire (not shown) of the product made from the product made from stainless steel, or tungsten in order to raise the hardness and pushing nature of the catheter 10 further -- it can provide in the base end of the catheter shaft 12.

[0023]If drawing 1 is referred to again, the two tubes 72 and 74 connected to the catheter shaft

12 are formed in the base end of the catheter 10. One tube is a thing for supply of the fluid for expansion, and is connected to the 3rd lumen 18. The tube of another side is a thing for supply of drugs, and is connected to the 4th lumen 20. The hub 78 is connected with each tube. A syringe can be used, in order to let the tubes 72 and 74 pass and to supply the fluid for expansion to the blockade balloons 22 and 24, and in order to supply the drugs of arbitrary requests. When it is applied for active inflow of the catheter 10 and the 2nd lumen 16 has extended even in the base end of the catheter shaft 12, the 3rd tube (not shown) can be attached to the 2nd lumen 16. When the additional lumen is provided, an additional tube can be attached to the catheter shaft 12. Or Y adapter can be attached. Drawing 5 is a sectional view showing a catheter shaft along five to 5 line of drawing 1, and the 3rd lumen 18 and the 4th lumen 20 are shown.

[0024]As for the outer diameter of the catheter 10 and the blockade balloons 22 and 24 in the state where it became narrower, it is preferred not to exceed about 0.056 inch (1.42 mm). Thereby, it can be used with 7 or 8 French guiding catheter (7 or 8 French guiding catheter).

[0025]At the place 80, the diameter of the base end 52 of an inside catheter shaft is about expanded even in outer diameter of about 0.140 inch (3.56 mm) so that the tubes 72 and 74 may be received. The tubes 72 and 74 of each other are held with the heat-shrinkable tubing 82. The tubes 72 and 74 are connected to the catheter shaft by heat adhesion or adhesives.

[0026]The tip 26 of the 1st lumen 14 is preferably provided with the elastic chip 96 which has a softer material as compared with the material of the catheter shaft 12. When a body tissue is contacted, the chip 96 spreads or it turns at it. Passage of the catheter which passes along a blood circulatory system is made easy by this, and it is useful for prevention of damage to an organization. The chip 96 can be formed from the ultra low density polyethylene 4603 by Dow Chemical Corporation. This material has a melt flow index (ASTM D-1238) of 0.7-0.9g / 10min, and the density (ASTM D-792) of 0.9030-0.9070g/cc in 190 **. The chip 96 can be made into nylon or the polyamide copolymer like PEBA 25D by Elf Atochem Deutschland GmbH. This material The tensile strength of a minimum of 4950 psi (ASTM D-638), It has a minimum of 640% of elongation (ASTM-638), a flexibility factor (ASTM D-790) of a minimum of 2100 psi, a durometer (ASTM D-2240) of 25D**4D, and the melting point (ASTM D-3418) of 142 ** - 153 **. The chip 96 can be connected to the catheter shaft 12 by adhesives or heat adhesion.

[0027]For position observation of the catheter by PTA or the X-ray fluorography at the time of a PTCA operation as the opaque marker 98 is known from the former, for example to the radiation made from gold or tantalum, It is preferred to be provided in the blockade balloon 22 and 24 at the catheter shaft 12, as shown in drawing 1. Such a marker can also be provided in the end face of other arrangement 32, for example, the port of the method of the last.

[0028]The catheter shaft 12 and the blockade balloons 22 and 24 are preferably coated with a charge of a sliding material like silicon, acrylicimide, or hydrophilic polyurethane coating.

Thereby, passage of the catheter 10 for drugs conveyance by this invention which passes along a guiding catheter is made easy as known from the former.

[0029]The arbitrary materials for a catheter with a suitable catheter shaft. For example, it can form from linearity low density polyethylene or high density polyethylene, nylon, polyamide, a polyamide copolymer, polyurethane, polypropylene, a polyester copolymer, silicone rubber, or other non-thrombogen formation materials. The product made from stainless steel, or Nitinol (Nitinol) The metal tube made from an available nickel titanium alloy can also be used, for example from Raychem Corporation in a similar manner [of make].

[0030]Suitable linearity low density polyethylene is Dowlex2038 by Dow Chemical Company. This material has a melt flow index (ASTM D-1238) of 0.85-1.15g / 10min, and the density (ASTM D-792) of 0.9330-0.9370g/cc in 190 **. Usable high density polyethylene is LB 8320-00 by Quantum Chemical Corporation. This material has a melt flow index (ASTM D-1238) of 0.20-0.36g / 10min, and the density (D-1505) of a minimum of 0.9566g/cc in 190 **.

[0031]Usable nylon is Nylon 12 like L2101F Vestamed by Huls America Inc. This material has the relative viscosity (ISO 307) of 2.05-2.22, and a maximum of 0.10 water content (ASTM D-4109). Other usable nylon is PEBA 70D by Elf Atochem. This material The tensile strength of a minimum of 8300 psi (ASTM D-638), It has a minimum of 400% of elongation (ASTM D-638), a flexibility factor (ASTM D-790) of a minimum of 67,000 psi, a durometer (ASTM D-2240) of 69D**4D, and the melting point (ASTM D-3418) of 160 ** - 180 **.

[0032]Usable high density polyethylene is LM6007 by Quantum Chemical Corporation. This material has the following characteristics.

Tensile strength A minimum of 4400 psi (ASTMD-638)

it can set to a burst -- being extended -- % -- a minimum of 600% (ASTM D-638)

D coefficient 68**4.5 of a durometer (ASTM D-2240)

0.070 (REF) at 240 ** and 2160 g

Melt flow index (ASTM D-1238)

Flexibility factor in a room temperature A minimum of 220,000 psi (ASTM D-790, the technique B)

Vicat softening temperature, ** 125 ** (REF)

(ASTM D-1525)

[0033]When it is requested that the tip part of the catheter shaft 12 is softer than other portions of a shaft, usable suitable nylon is PEBA 63D by Elf Atochem. This material The tensile strength of a minimum of 8100 psi (ASTM D-638), It has a minimum of 300% of elongation (ASTMD-638), a flexibility factor (ASTM D-790) of a minimum of 49,000 psi, a durometer (ASTM D-2240) of 63D**4D, and the melting point (ASTM D-3418) of 160 ** - 180 **.

[0034]The catheter shaft 12 provided with the lumen of a desired number can be manufactured by the conventional extrusion process. In order to form the expanding part of the catheter shaft

12, a vamp extrusion process can be used as known in conventional technology. It can replace with the integral-type catheter shaft 12 with a lumen, and two or more individual tubes connected mutually can be used.

[0035]The elastic chip 96 can be attached to a catheter shaft by carrying out heat adhesion in a prescribed position by arranging the small tube of the charge of a chipped material on the tip of the catheter shaft 12. Similarly, adhesives can be used. The catheter shaft 12 will increase the charge of a tube material. In order to maintain the outer diameter of the catheter shaft 12 after arrangement of the tube of the charge of a chipped material smaller than about 0.056 inch (1.42 mm), In advance of attachment of the charge of a chipped material, only a suitable quantity "being able to shut (necked-down)" the tip part of a catheter shaft. [make able to decrease it or] In order to attach an elastic chip by heat adhesion, maintaining the lumina 14 and 16 to an opening state, an axis is inserted into each lumen. The tube of the charge of a chipped material can extend even to the field to which the tip blockade balloon 22 of the catheter shafts 12 is attached. In this case, all or some of balloons 22 can attach to the charge of a chipped material.

[0036]At the time of heat adhesion of the charge of a chipped material, the tip part of the 3rd lumen 18 and the 4th lumen 20 is blockaded. When it is required to blockade more portions of one of lumina, the small solid tube made from the same material as the catheter shaft 12 is inserted into the end face of the lumen, and heat adhesion is carried out after that in a prescribed position. Adhesives can be used similarly. The thing large more slightly than the diameter of said lumen of the outer diameter of a tube is preferred. An axis maintains other lumina to an opened condition. When the 3rd lumen 18 is not blockaded at the time of attachment of the elastic chip 96, it can blockade like the 4th lumen.

[0037]The seal of the base end of the 1st lumen 14 and the 2nd lumen 16 can be carried out similarly.

[0038]The blockade balloons 22 and 24 Nylon, polyamide, a polyamide copolymer, It can form from polyethylene, polyethylene terephthalate, a polyester elastomer, polyurethane, Kapton (Kraton), silicone, latex, or other arbitrary flexible non-thrombogen formation materials. Although the blockade balloons 22 and 24 do not blow up a blood vessel wall when it swells, they carry out the seal of the blood vessel wall. A balloon can be used as the balloon by which could consider it as the tube which swells by expansion, or blow molding was carried out. When balloon material has conformity to the catheter shaft 12, the blockade balloons 22 and 24 can be attached by heat adhesion art including laser adhesion. The device and method for carrying out laser adhesion of the balloon on a catheter are indicated by U.S. Pat. No. 5,267,959. This literature is incorporated here for reference. Adhesives can be used similarly. Nylon usable as the blockade balloons 22 and 24 is L25G Grilamid by EMS-Chemie AG. This material The melting point of 178 **, the density of 1.01 kg/dm^3 (DIN 53479), It has the tensile

strength (DIN 53455) of 40N[/mm] ^{2}, the elongation (DIN 53455) in 10% of burst, and the Shore (Shore)D hardness (DIN 53505) of 72.

[0039]After expansion is attained by the usual method, the catheter for drugs conveyance by a 1st embodiment of this invention can be used even for the treatment part by the PTA method or the PTCA method in order to convey drugs. An expansion catheter consists of a quick exchange format which is indicated by Mr. Bonzel's U.S. Pat. No. 4,762,129 preferably, for example. This literature is incorporated here for reference. Such a catheter is removed first. After that, the catheter 10 for drugs conveyance of this invention is introduced in a blood circulatory system, and is carried forward even to an expansion part via a guiding catheter along with the same guidewire that showed said expansion catheter even to the strangulation part. An exchange wire is not required at all and the guidewire needs to project only about 75 cm from the body. The tip of the 1st lumen 14 of the catheter 10 is inserted into a guidewire like the guidewire 28 shown in drawing 1. When a catheter advances along with a guidewire, the guidewire has come out of the opening 30 of the catheter 10. The catheter 10 continues being conveyed along with the portion located in the 1st lumen 14 of the guidewires, when moving forward even to an expansion part.

[0040]The progress condition of the catheter 10 is pursued by X-ray fluorography. When it arrives at an expansion part, it swells through the 3rd lumen 18 until the blockade balloons 22 and 24 carry out the seal of the arterial wall in contact with an arterial wall. When the openings 32 and 30a for inflow exist, it flows through the 2nd lumen 16 and the 1st lumen 14, and flows out of the tip part of the catheter 10, respectively. When it is constituted so that the catheter 10 can perform active inflow (.) Namely, when the 2nd lumen 16 has extended covering the whole length of the catheter shaft 12. Blood or a fault fluorine compound like Fluosol (registered trademark), and recombination nature hemoglobin can be poured in by a syringe via the tube 76 as known in conventional technology.

[0041]An anti-thrombolysis agent, an anti-growth agent, or drugs arbitrary type [other] can be poured in by a syringe here through the tube 72, the 4th lumen 20, and also the port 36 for drugs conveyance. One effective gestalt of drugs is the dexamethasone made to stick to the polylactic acid / polyglycolic acid particles of a diameter smaller than 100 microns substantially. Such particles stick to an arterial wall, or can penetrate an arterial wall. A particle surface can be processed with cell adsorptivity protein, in order to heighten the adsorption power of the particles to an arterial wall. Peptide based on usable arginine glycine aspartic acid is Peptite 2000 (registered trademark) by Telios Pharmaceuticals and Inc.

[0042]After continuing for desired time (typically about 20 seconds - 3 minutes) and applying drugs by a desired pressure, a blockade balloon is ******(ed) and the catheter 10 for drugs conveyance is drawn out promptly and easily from a blood vessel.

[0043]Drawing 7 is a figure showing the tip part of a 2nd embodiment of this invention in a flat

surface and a section, and the catheter 100 which can perform both extension and drugs conveyance is shown. The catheter 100 is provided with the catheter shaft 110 which has the 1st lumen 112, the 2nd lumen 114, the 3rd lumen 116, and the 4th lumen 118. The inflation balloon 120 and the two blockade balloons 122 and 124 are attached to the catheter shaft 110. The free passage of the 1st lumen 112 and a fluid of the inflation balloon 120 is enabled through the opening 126. The free passage of the 4th lumen 118 and a fluid of both blockade balloons is similarly enabled through the opening 128. The wall of the catheter shaft 110 is penetrated in the 2nd lumen 114, the port 130 is established in it, it can let this port 130 pass, and medication to an expansion part can be performed. The additional lumen for drugs conveyance can be provided like the above. The additional lumen can provide a fluid to the blockade balloons 122 and 124 as opposed to the inflation balloon 120 similarly. The wall of the catheter shaft 110 is penetrated to the 3rd lumen 116, and the opening 132 is formed in it. The 3rd lumen 116 that penetrated the opening 133 in the tip 134 of the catheter 100, and has extended has accommodated the guidewire 136 which exists in this lumen 116 through the opening 132. an additional lumen (not shown) -- it may provide for active or passive inflow. The tip of such a lumen for inflow is preferably made into tapered shape as mentioned above. The above slide coating is applied to the inflation balloon 120 and the remaining portion of the catheter 100. As mentioned above, it can replace with the integral-type catheter shaft which has two or more lumina, and the catheter shaft 110 can consist of two or more tubes combined appropriately mutually.

[0044]The inflation balloon 120 can be made into the thing of the suitable arbitrary types for the PTA method and the PTCA method, and size. For example, the balloon 120 can be formed from polyethylene, polyethylene terephthalate, nylon, polyamide, a polyamide copolymer, polyurethane, or other arbitrary materials suitable as an inflation balloon. the balloon 120 -- adaptability and non-adaptability -- or -- half--- suppose that it is flexible. The inflation balloon 120 can be attached to the catheter shaft 110 with the heat adhesion including laser adhesion or ultrasonic bonding or adhesives as known in conventional technology. As for the balloon 120, it is preferred that it is the same material as the catheter shaft 110, or is a conformable material so that heat adhesion may be possible.

[0045]Low density polyethylene usable as the inflation balloon 120 is P.E.1031 by RexeneCorporation. In 190**0.2 **, this material The melt flow index of 0.4-1.4g / 10min (ASTM D-1238), It has the density (ASTM D-1505) of 0.93**0.02g/cc, and the melting point (ASTM D-3417, D-3418) of 104-140 **. Usable linearity low density polyethylene is Dowlex2247A LLPDE by Dow Chemical Corporation. In 190 **/2.16 kg, this material The melt index of 2.0-2.6g / 10min (ASTM D-1238), It has the density (ASTM D-1505) of 0.9150-0.9190g/cc, and the melting point (D-3417, D-3418 (REF)) of 122-125 **.

[0046]The material mentioned above in relation to a 1st embodiment is suitable for other

corresponding members in this embodiment. The radiation opaque marker 138 is established under the blockade balloons 122 and 124 under the inflation balloon 120 like a 1st embodiment again at the catheter shaft 110. The structure of the end face of the catheter 100 is intrinsically [as the end face of the catheter 10 shown in drawing 1] the same. However, only the point that the 3rd tube for supplying the fluid for expansion to the inflation balloon 120 through the 1st lumen 112 is attached is different from the end face of the catheter shaft 110. Y adapter can be used again as known in conventional technology.

[0047]At the time of use, the catheter 100 of this embodiment is inserted in a guidewire like the guidewire 136 already advanced even to the strangulation part by the guiding catheter as known in conventional technology. It invaded through the opening 134 in the catheter 100, and has come out from the 3rd lumen 116 through the opening 132. As mentioned above, when some catheters 100 are carrying out friction engagement with the guidewire, while being able to follow a catheter to a strangulation part easily and promptly, the guidewire to be used is short and ends. When arranged properly, the inflation balloon 120 can swell by the conventional method, in order to open a strangulation part. Then, it is made to become narrower about the inflation balloon 120, and the blockade balloons 122 and 124 can be blown up as mentioned above. The drugs of arbitrary requests can be supplied through the 2nd lumen 114 after that. By the ability to perform both extension and drugs conveyance as it is also with the same catheter, in this embodiment, time required to draw out the catheter for expansion and insert the catheter for drugs conveyance of a different body further can be saved, and operation time can be shortened. In addition, in this embodiment, the problem of the exact rearrangement to the expansion part for the optimal location and allocation of the catheter for drugs conveyance can be eased.

[0048]In a 3rd embodiment of this invention, both extension of a strangulation part and drugs conveyance to an extended part can be performed as, as for the catheter 200, the same inflation balloon is also. Drawing 8 is a figure showing the tip part of such a catheter 200 in a flat surface and a section, and the state where the inflation balloon expanded is shown. The catheter 200 is provided with the catheter shaft 210, the 1st lumen 212, the 2nd lumen 214, and the 3rd lumen 216. The 2nd lumen 214 has accommodated the guidewire 218 through the opening 219. In order to form the exit of the guidewire 218, the catheter shaft 210 is penetrated in the 2nd lumen 214, and the opening 217 is formed in it. It can replace with the integral-type catheter shaft which has two or more lumina, and the catheter shaft 210 can consist of two or more tubes combined appropriately mutually.

[0049]The balloon part of the catheter 200 is provided with the outside balloon 220 and the inner balloon 230. The 2nd lumen 214 inserted in the inside of the inner balloon 230, and has extended. The tip of the outside balloon 220 is pasted up with heat or adhesives to the tip of the inner balloon 230.On the other hand, at the place 240, the tip of the inner balloon 230 is

pasted up with heat or adhesives to the outside surface of the 2nd lumen 214. Both the end faces of the outside balloon 220 and the inner balloon 230, To the catheter shaft 210, it is in the state in which the middle field of an outside balloon and an inner balloon is carrying out fluid communicating to the 1st lumen 212, and has pasted up with heat or adhesives in the state where the inside of the inner balloon 230 is carrying out fluid communicating to the 3rd lumen 216. The fluid for expansion is supplied through the 3rd lumen 216, and drugs are supplied through the 1st lumen 212. In order that two or more micropores 280 may emit drugs from a balloon, the wall of the outside balloon 220 is penetrated and it is formed. Such a hole can be 0.01 micron - 0.1 mm. When the outer layer of the balloon 220 is provided with polyethylene terephthalate, nylon, or biaxial orientation plastic material like a polyester elastomer, the micropore 280 can be formed using high-precision laser.

[0050]At the time of use, the guidewire 218 is advanced to the fault part with which it should deal via a guide catheter by the conventional method. The tip of the 2nd lumen 214 is attached over the base end of the guidewire 218. The guidewire has come out from the catheter 200 through the opening 217 like both the above-mentioned embodiments. The catheter 200 continues advance along with the portion in the 2nd lumen 214 of the guidewires until it arrives at the fault part where it should deal with a balloon part. In drawing 8, the inner layer 230 and the outer layer 220 of the balloon part are illustrated by the expanding state, however when these layers move forward to a strangulation part, they are in the state where it stuck to the outside surface of the lumen 214.

[0051]If the tip part of the catheter 200 is appropriately arranged using the radiation opaque marker band 242, selected drugs will let the 1st lumen 212 pass, and will be introduced into the staging area of outside balloon 220 and the inside balloon 230. Although pouring of drugs brings about some extension of the outside balloon 220, typically, the pressure that drugs are poured in is smaller than the pressure that the quantity of drugs will be substantially emitted from the micropore 280. In order to perform both drugs conveyance and extension simultaneously next, the fluid for expansion lets the 3rd lumen 216 pass, and is poured in inside the inner balloon 230. If a pressure increases and 7-8 atmospheres will be reached typically, the inner layer 230 of a balloon will swell even to a predetermined maximum diameter. And by swelling in this way, to the fault part with which it deals that it is also with special drugs, it can let the port 280 pass and drugs can be sprinkled effectively. While the pressure which acts to a fault part is brought about again and drugs apply by expansion of the inner balloon 230, forcing to a blood vessel wall can be performed.

[0052]Use of the balloon for conveyance of the drugs to the expansion part by the catheter for drugs conveyance of this invention is shown in a 4th embodiment of drawing 9. The catheter 300 is provided with the balloon 312 for drugs conveyance attached by heat or adhesives to the catheter shaft 310 as mentioned above. The balloon 312 is shown by the expanding state

in drawing 9. Two or more ports 314 for drugs conveyance are formed over the balloon 312. The balloon 312 lets the port 318 which penetrates the wall of the catheter shaft 310 pass, and is carrying out fluid communicating to the lumen 316 for drugs conveyance. The additional lumen for drugs conveyance can be provided again. The lumen 320 for guidewires penetrates the tip 322, and is provided in the tip part of the catheter shaft 310. The termination of the lumen 320 for guidewires is carried out to the end face side of the balloon 312 for drugs conveyance of the tip parts of the catheter shaft 310. The opening 324 which is open for free passage to the lumen 320 for guidewires is formed in the wall of the catheter shaft 310. The guidewire 326 can be inserted through the opening 328 in the tip 322 of the catheter shaft 310, and can be taken out through the opening 324.

[0053]It is preferred to form the lumen 330 for inflow in which the tapered shape end 330a was formed. As mentioned above, this lumen can extend covering the whole length of the catheter shaft 310 so that active inflow may be enabled. It can replace with this and the termination of this lumen can be carried out to the end face side of the balloon 312 for drugs conveyance. In that case, in order to enable active inflow, like a 1st embodiment, the wall of the catheter shaft 310 can be penetrated and two or more openings (not shown) can be provided. It can replace with the integral-type catheter shaft provided with two or more lumina, and the catheter shaft 310 can consist of two or more tubes pasted up appropriately mutually.

[0054]A 5th embodiment of the invention in this application combines a space expansion function and a local drugs carrying function with the balloon extension type stent. The non-expanding state and the expanding state are shown in drawing 10, 11 and drawing 12, and 13, respectively. The catheter 400 is provided with the object for double-wall type expansion and the balloon 412 for drugs conveyance which it was welded or were pasted up on the catheter shaft 401 like ****, the 1st lumen 405, the 2nd lumen 406, and the 3rd lumen 407. The 2nd lumen 406 has received the guidewire 418 through the opening 419. To the 2nd lumen 406, the catheter shaft 401 is penetrated and the opening 417 is formed. This opening 417 can make the exit for the guidewire 418. It can replace with the integral-type catheter shaft in which two or more lumina are provided, and the catheter shaft 401 can also consist of two or more tubes pasted up mutually again.

[0055]The double-wall balloon 412 is the same as the double-wall balloon in a 3rd embodiment of this invention. The stent 440 which can be balloon expanded is attached to the double-wall balloon. Means of attachment can be performed by other arbitrary methods of demounting the stent from a double-wall balloon at the time of engagement, and balloon expansion and stent deployment.

[0056]At the time of use, the guidewire 418 is advanced to the fault part with which it should deal via a guide catheter by the conventional method. The tip 419 of the 2nd lumen 406 is attached over the base end of the guidewire 418. The guidewire has come out from the

catheter 400 through the opening 417 like both the above-mentioned embodiments. The catheter 400 continues advance along with the portion in the 2nd lumen 406 of the guidewires until it arrives at the fault part where it should deal with a balloon part. In drawing 10 - drawing 13, the inner layer 430 and the outer layer 420 of the balloon part are illustrated by the expanding state, however when these layers move forward to a strangulation part, they are in the state where it stuck to the outside surface of the lumen 419.

[0057]If the tip part of the catheter 400 is appropriately arranged using the radiation opaque marker band 442, selected drugs will let the 3rd lumen 407 pass, and will be introduced into the staging area of outside balloon 430 and the inside balloon 420. Although pouring of drugs brings about some extension of the outside balloon 430, typically, the pressure that drugs are poured in is smaller than the pressure that the quantity of drugs will be substantially emitted from the micropore 428. In order to perform drugs conveyance, extension of strangulation, and arrangement of the stent simultaneously next, the fluid for expansion lets the 1st lumen 405 pass, and is poured in inside [421] an inner balloon. If a pressure increases and 7-8 atmospheres will be reached typically, the inner layer 420 of a balloon will swell even to a predetermined maximum diameter. And while being able to sprinkle drugs effectively to the fault part with which it deals that it is also with special drugs by swelling in this way, the stent is expanded and the stent can be pushed to a blood vessel wall. Drugs are emitted from the hole of an outside balloon and permeate through the lattice of the stent.

[0058]In the catheter for drugs conveyance and the catheter for expanded type drugs conveyance by this invention, advance and drawing out of a quick and easy catheter are possible, and, therefore, the time which an operation takes can be shortened. A required staff and device can be omitted and operation cost can be reduced.

[0059]In the above, although the desirable embodiment of this invention has been described, the above-mentioned embodiment does not restrict the range of this invention, and the range of this invention is defined by the claim.

[Translation done.]

* NOTICES *

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TECHNICAL FIELD

[Field of the Invention]This invention relates to the catheter for balloon expansion type drugs conveyance, and the catheter for stent deployment type drugs conveyance, and is provided with the lumen for guidewires which carries out a termination into a catheter shaft, and the opening for taking out a guidewire from a catheter shaft.

[Translation done.]

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PRIOR ART

[Description of the Prior Art]A percutaneous transluminal arterioplasty ("PTA") and the percutaneous transluminal coronary-arteries plasty ("PTCA") expand an inflation balloon, in order to carry forward an inflation balloon to a strangulation part through a blood circulatory system and to open a barrier, and they are the usual method of operation nowadays. However, in about 1/3 of such an operation, the restenosis occurs and the further extended operation is needed.

[0003]Various drugs which may reduce the restenosis are applicable to a strangulation part. For example, an anti-thrombolysis agent like heparin can prevent a blockade. The thrombogen formation can cause various phenomena which may bring about the restenosis. An anti-growth agent like dexamethasone can prevent movement and growth of smooth muscle cells.

[0004]Various methods are proposed in order to convey such drugs effectively to an extended part. For example, the catheter which equipped Mr. Wolinsky's U.S. Pat. No. 5,087,244 with the light-gage flexible balloon in which two or more stomata were formed is indicated. After completion of an angioplasty, such a balloon is carried forward to an extended part, and expands with heparin or other drugs. Drugs let a stoma pass and are emitted from the inflation balloon in contact with an arterial wall.

[0005]The catheter provided with the conduit tube for drugs conveyance is indicated by Mr. Wolinsky's U.S. Pat. No. 4,824,436 and U.S. Pat. No. 4,636,195. The conduit tube for drugs conveyance is provided among the blockade balloons of a couple. The embodiment by which the inflation balloon which makes possible the both sides of the expansion which uses the same catheter, and drugs conveyance was provided among the blockade balloons of a couple is indicated.

[0006]Other objects for expansion and the catheter for drugs conveyance are indicated by U.S. Pat. No. 4,994,033 of Shockey Mr. others. In this case, the double layer balloon in which two or more stomata were formed in the outer layer is provided. Drugs are introduced between two

layers and the fluid for expansion is introduced into the inside of a balloon. While strangulation expands, drugs are directly applied to the extended organization by the pressure of the fluid for expansion.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]Typically, the object for drugs conveyance and the catheter for expansion are carried forward even to an extended part along with the guidewire accommodated in the lumen for guidewires which penetrated the whole shaft of the catheter and has extended. For the frictional force between a guidewire and a catheter, advance and removal of a catheter are difficult and time has required them.
[0008]In addition, when the whole catheter has covered the guidewire, to insert or exchange wires for a wrap catheter, the guidewire needs to project only length longer than the length of a catheter from the patient's body. The portion which length is about 300 cm and such a guidewire has in the outside of the body is about 230 cm. Otherwise, a guidewire cannot be fixed and arrangement [/ near the obstacle] cannot be maintained. It can replace with such a long guidewire and an exchange wire can be connected to the portion in the outside of the body of the guidewires at the time of exchange of a catheter. An exchange wire requires that length should be at least 180 cm. In the case of which, in order to deal with a long wire, at the time of operation, an additional operator is required. Even though an additional operator is needed, operation of the catheter at the time of exchange is inconvenient. Therefore, the length and expense of an operation will increase unnecessarily.

[Translation done.]

MEANS

[Means for Solving the Problem]At least one port for drugs conveyance in which it is located a tip and near this tip in an embodiment with this invention, And a catheter for drugs conveyance possessing a catheter shaft provided with at least one lumen for drugs conveyance for supplying drugs to this port for drugs conveyance is proposed. A catheter shaft is further provided with a lumen for guidewires which migrates even to a terminal point from a tip of a catheter shaft, and extends in a catheter shaft. A terminal point is arranged rather than a port for drugs conveyance at the end face side, and an opening for taking out a guidewire from a catheter shaft is formed near the terminal point. Therefore, a catheter shaft is only a wrap in a part of mere guidewire which extends over the outside of the body, and needs neither a long guidewire nor an exchange wire. Preferably, a blockade balloon is provided in order to isolate a drugs transportation area. It is preferred that an additional lumen for inflow is provided. As for a tip of a lumen for inflow, being considered as tapered shape is preferred.
[0010]In other embodiments of this invention, a catheter for expanded type drugs conveyance possessing a catheter shaft provided with a tip part, a tip, and a end face is proposed. An inflation balloon is attached to a tip part of a catheter shaft. The 1st blockade balloon is attached to the tip side position rather than an inflation balloon to a catheter shaft, and the 2nd blockade balloon is attached to the end face side position rather than an inflation balloon to a catheter shaft. In between [at least one] of an inflation balloon and the blockade balloons, a catheter shaft equips a tip part of a catheter shaft with at least one port for drugs conveyance further. At least one lumen for expansion which circulation of a fluid opened for free passage possible to a balloon for expansion is provided. at least one which circulation of a fluid opened for free passage possible to a balloon for a blockade -- swelling -- business -- a lumen is provided. At least one lumen for drugs conveyance which circulation of a fluid opened for free passage possible to a port for drugs conveyance is provided similarly.
[0011]A lumen for guidewires is provided in a tip part of a catheter shaft. The 1st opening that

carries out the opening of the lumen for guidewires to the exterior of a catheter shaft in a tip of a catheter shaft, And it has the 2nd opening that carries out an opening to the exterior of a catheter shaft in a tip part which is a end face side and is substantially located in the tip side rather than a base end of a catheter shaft rather than the 2nd blockade balloon of the catheter shafts. The guidewire can enter in a catheter shaft through the 1st opening, and can come out of a catheter shaft through the 2nd opening. As mentioned above, when the whole catheter shaft has not covered a guidewire, neither a long guidewire nor an exchange wire is required. A problem of a time lag for rearrangement and catheter displacement to a strangulation part after extension is avoided by the ability to carry out that it is also with the same catheter with both extension of a strangulation part, and drugs conveyance.

[0012]In embodiment of a catheter for expanded type drugs conveyance by this invention another again, an inflation balloon attached to a tip part of a catheter shaft has an outer layer and a inner layer. A inner layer forms an interior area near the catheter shaft, and an outer layer and a inner layer form an external area. An outer layer has two or more openings. Circulation of a fluid is opening the 1st lumen for free passage possible to an outside area, and circulation of a fluid is opening the 2nd lumen for free passage possible to an inner area. The 3rd lumen for accommodating a guidewire is provided in a tip part of a catheter shaft. The 1st opening that carries out the opening of the 3rd lumen to the exterior of a catheter shaft in a tip of a catheter shaft, And it has the 2nd opening that carries out an opening to the exterior of a catheter shaft in a tip part which is a end face side and is substantially located in the tip side rather than a base end of a catheter shaft rather than an inflation balloon of the catheter shafts. The guidewire can enter in a catheter shaft through the 1st opening, and can come out of a catheter shaft through the 2nd opening.

[0013]In another embodiment of this invention, a balloon for drugs conveyance with two or more ports is attached to a tip part of a catheter shaft. A catheter shaft is provided with a lumen provided in a tip part of a catheter shaft in order to accommodate further at least one lumen for conveyance which circulation of a fluid opened for free passage possible to a balloon for drugs conveyance, and a guidewire. The 1st opening that carries out the opening of the lumen for guidewires to the exterior of a catheter shaft in a tip of a catheter shaft, And it has the 2nd opening that carries out an opening to the exterior of a catheter shaft in a tip part which is a end face side and is substantially located in the tip side rather than a base end of a catheter shaft rather than a balloon for drugs conveyance of the catheter shafts. Also in this case, the guidewire can enter in a catheter shaft through the 1st opening, and can come out of a catheter shaft through the 2nd opening. It is preferred that a lumen for inflow is provided. As for a lumen for inflow, it is preferred to have a tapered shape tip.

[0014]In further embodiment of this invention, a drugs transportation means is combined with both sides of space expansion and arrangement of stent which can be balloon expanded in the

same catheter shaft.

[0015]

[Embodiment of the Invention]Drawing 1 is a figure showing the catheter for drugs conveyance by one embodiment of this invention, about the tip part of the catheter, is expanded and is illustrated in the section. Drawing 2 is a sectional view showing the tip part of the catheter shown in drawing 1 along two to 2 line of drawing 1. Drawing 3 is a sectional view in which 90 degrees' rotating and showing the tip part of the catheter shown in drawing 1. Drawing 4 is a sectional view showing the tip part of the catheter shown in drawing 3 along four to 4 line of drawing 3. Drawing 5 is a sectional view showing the base end of the catheter shown in drawing 1 along five to 5 line of drawing 1. Drawing 6 is a top view showing the catheter shown in drawing 3 with the blockade balloon which expanded. Drawing 7 is a figure showing the tip part of a 2nd embodiment of this invention in a flat surface and a section. Drawing 8 is a figure showing the tip part of a 3rd embodiment of this invention in a flat surface and a section. Drawing 9 is a figure showing a 4th embodiment of this invention in a flat surface and a section. Drawing 10 - drawing 13 are the figures showing a 5th embodiment of this invention.

[0016]Drawing 1 - drawing 6 show one embodiment of the catheter 10 for drugs conveyance by this invention. In drawing 1, the tip part of the catheter 10 is expanded and is shown by the section. The catheter 10 is provided with the catheter shaft 12. Preferably, the two blockade balloons 22 and 24 are attached to the tip part of the catheter shaft 12. The 1st lumen 14 that migrates even to the about 24 blockade balloon terminal point 14a from the tip 26 of the catheter shaft 12, and extends is formed so that the guidewire 28 may be received. The opening 30 is formed in the wall of the catheter shaft 12 [near the terminal point 14a]. Preferably, the 1st lumen 14 is arranged near the edge part of the catheter shaft 12. The guidewire 28 can pass along the opening 31 in the tip part 26 of the catheter shaft 12, and can enter into the 1st lumen 14 of the catheter shaft 12, and can come out of the opening 30. Substantially, the opening 30 is located in the tip side of the base end of the catheter 10. The diameter of the 1st lumen can be about 0.022 inch (0.56 mm). At the time of use, the tip part of the guidewire 28 is projected from the tip of the lumen 14, as shown in drawing 1. As for the distance between the tip of a catheter, and the opening 30, it is preferred that it is about 5-25 cm. Although shorter longer or length is possible for the total length of the catheter 10 for drugs conveyance, it can be begun from 120-160 cm. It is not necessary to use too long a wire according to the guidewire 28 being able to come out of the catheter shaft 12 through the opening 30. It is not necessary to use an exchange wire. When removing from the body, a part of mere guidewire which extends over the outside of the body is because it is covered by the catheter 10. Therefore, when the catheter 10 of this invention is inserted into the body or is removed, sufficient allowance for being held in a prescribed position exists in a guidewire. In the catheter 10 by this invention, the guidewire 28 only projects about 75 cm from the body.

[0017]Preferably, the 2nd lumen 16 migrated even to the about 24 blockade balloon terminal point 16a from the tip 26 of the catheter shaft 12 again, and has extended. The diameter of the 2nd lumen can be about 0.013 inch (0.33 mm). Preferably, the wall of the catheter shaft 12 is penetrated and two or more ports 32 are formed so that it may be open for free passage to the 2nd lumen 16. Two or more ports 32 can enable active inflow of the blood which lets a lumen pass so that it may explain further below. It is preferred that the port 32 of circular or an ellipse form a diameter or whose length is 2-20 about 0.003-0.020 inch (0.076-0.51 mm) pieces, respectively is formed. The three openings 32 for inflow are formed in this embodiment. The port 30a which is open for free passage to the 1st lumen 14 for enabling similarly inflow of the blood which lets the 1st lumen 14 pass can be formed between the end face blockade balloon 24 and the opening 30. As for the tip 16b of the 2nd lumen 16, as shown in drawing 1, it is preferred that it is tapered shape. The opening in the tip 16b being able to become difficult to be seen, mistaking to the 1st lumen 14 by this, at the time of use, and inserting the guidewire 28 into the 2nd lumen 16 is prevented. Active inflow of the perfluorochemical known from blood or the former or recombination nature hemoglobin is enabled so that it replaces with such composition, and the lumen 16 may be made to extend covering the whole length of the catheter shaft 12 and this may explain it below.

[0018]Drawing 2 is a sectional view which meets two to 2 line of drawing 1, and shows the 3rd lumen 18 and the 4th lumen 20 to the 1st lumen 14 and the 2nd lumen 16, the port 32, and the pan. The 3rd lumen 18 and the 4th lumen 20 are explained with reference to drawing 3.

[0019]Drawing 3 is a sectional view in which 90 degrees' rotating and showing the tip part of the catheter 10. The graphic display abbreviation of the guidewire 28 is carried out. The 3rd lumen 18 is shown in the figure. This 3rd lumen 18 is for letting the port 34 which penetrates the catheter shaft 12 pass to the blockade balloons 22 and 24, and supplying the fluid for expansion. Preferably, in order to blow up the both sides of the balloons 22 and 24, the single lumen 18 is used. The diameter of the 3rd lumen 18 can be set to about 0.010 (0.25 mm). Similarly, two or more lumina isolated to each balloons 22 and 24 can also be provided.

[0020]The 4th lumen 20 for conveying drugs is illustrated again. Among blockade balloons, at least one port 36 for drugs conveyance penetrates the catheter shaft 12, and it is provided so that it may be open for free passage to the 4th lumen 20. The diameter of the 4th lumen 20 can be set to about 0.010 (0.25 mm). In order to make conveyance of suitable drugs to an expansion part into a positive thing, it is preferred that the port 36 of circular or an ellipse form a diameter or whose length is 2-20 about 0.003-0.020 inch (0.076-0.51 mm) pieces, respectively is formed. In drawing 3, the number of such ports is three. The drugs of arbitrary requests can be conveyed by the 4th lumen 20 to an expansion part. Drawing 4 is a sectional view by four to 4 line of drawing 3 of the catheter shaft 12, and the arrangement situation of two or more lumina which can be set to drawing 3 is shown. The additional lumen for drugs

conveyance can be provided.

[0021]As for the blockade balloons 22 and 24, at the time of drugs conveyance, it is preferred that an expansion part can be isolated. The blockade balloons 22 and 24 maintain drugs near [where it already swelled of the arterial walls] the portion. Thereby, absorption and validity of drugs improve. Drawing 6 is a top view of the catheter 10 of direction of drawing 3, and the blockade balloons 22 and 24 blown up at the time of drugs conveyance just before drugs conveyance are shown. The port 36 for drugs conveyance is also illustrated by the guidewire 28 and pan which have come out of the opening 30 and the opening 30. The opening 32 for inflow is located in the other side of a catheter in this figure.

[0022]It can replace with the integral-type catheter shaft 12 provided with two or more lumina, and the catheter shaft 12 can be provided with two or more tubes pasted up appropriately mutually. In addition, it can expand in drawing 6 and the tip part of the shown catheter shaft 12 can be formed from a material softer than other portions of a shaft. If formed from material with a soft tip part, the operativity which lets a blood circulatory system pass can be raised. On the other hand, pushing nature can be made good if the remaining portion of the shaft is formed from a harder material. These two portions can only be combined with heat adhesion or adhesives which is known in conventional technology. A suitable material is mentioned later. the wire (not shown) of the product made from the product made from stainless steel, or tungsten in order to raise the hardness and pushing nature of the catheter 10 further -- it can provide in the base end of the catheter shaft 12.

[0023]If drawing 1 is referred to again, the two tubes 72 and 74 connected to the catheter shaft 12 are formed in the base end of the catheter 10. One tube is a thing for supply of the fluid for expansion, and is connected to the 3rd lumen 18. The tube of another side is a thing for supply of drugs, and is connected to the 4th lumen 20. The hub 78 is connected with each tube. A syringe can be used, in order to let the tubes 72 and 74 pass and to supply the fluid for expansion to the blockade balloons 22 and 24, and in order to supply the drugs of arbitrary requests. When it is applied for active inflow of the catheter 10 and the 2nd lumen 16 has extended even in the base end of the catheter shaft 12, the 3rd tube (not shown) can be attached to the 2nd lumen 16. When the additional lumen is provided, an additional tube can be attached to the catheter shaft 12. Or Y adapter can be attached. Drawing 5 is a sectional view showing a catheter shaft along five to 5 line of drawing 1, and the 3rd lumen 18 and the 4th lumen 20 are shown.

[0024]As for the outer diameter of the catheter 10 and the blockade balloons 22 and 24 in the state where it became narrower, it is preferred not to exceed about 0.056 inch (1.42 mm). Thereby, it can be used with 7 or 8 French guiding catheter (7 or 8 French guiding catheter).

[0025]At the place 80, the diameter of the base end 52 of an inside catheter shaft is about expanded even in outer diameter of about 0.140 inch (3.56 mm) so that the tubes 72 and 74

may be received. The tubes 72 and 74 of each other are held with the heat-shrinkable tubing 82. The tubes 72 and 74 are connected to the catheter shaft by heat adhesion or adhesives.
[0026]The tip 26 of the 1st lumen 14 is preferably provided with the elastic chip 96 which has a softer material as compared with the material of the catheter shaft 12. When a body tissue is contacted, the chip 96 spreads or it turns at it. Passage of the catheter which passes along a blood circulatory system is made easy by this, and it is useful for prevention of damage to an organization. The chip 96 can be formed from the ultra low density polyethylene 4603 by Dow Chemical Corporation. This material has a melt flow index (ASTM D-1238) of 0.7-0.9g / 10min, and the density (ASTM D-792) of 0.9030-0.9070g/cc in 190 **. The chip 96 can be made into nylon or the polyamide copolymer like PEBA 25D by Elf Atochem Deutschland GmbH. This material The tensile strength of a minimum of 4950 psi (ASTM D-638), It has a minimum of 640% of elongation (ASTM-638), a flexibility factor (ASTM D-790) of a minimum of 2100 psi, a durometer (ASTM D-2240) of 25D**4D, and the melting point (ASTM D-3418) of 142 ** - 153 **. The chip 96 can be connected to the catheter shaft 12 by adhesives or heat adhesion.
[0027]For position observation of the catheter by PTA or the X-ray fluorography at the time of a PTCA operation as the opaque marker 98 is known from the former, for example to the radiation made from gold or tantalum, It is preferred to be provided in the blockade balloon 22 and 24 at the catheter shaft 12, as shown in drawing 1. Such a marker can also be provided in the end face of other arrangement 32, for example, the port of the method of the last.
[0028]The catheter shaft 12 and the blockade balloons 22 and 24 are preferably coated with a charge of a sliding material like silicon, acrylicimide, or hydrophilic polyurethane coating. Thereby, passage of the catheter 10 for drugs conveyance by this invention which passes along a guiding catheter is made easy as known from the former.
[0029]The arbitrary materials for a catheter with a suitable catheter shaft. For example, it can form from linearity low density polyethylene or high density polyethylene, nylon, polyamide, a polyamide copolymer, polyurethane, polypropylene, a polyester copolymer, silicone rubber, or other non-thrombogen formation materials. The product made from stainless steel, or Nitinol (Nitinol) The metal tube made from an available nickel titanium alloy can also be used, for example from Raychem Corporation in a similar manner [of make].
[0030]Suitable linearity low density polyethylene is Dowlex2038 by Dow Chemical Company. This material has a melt flow index (ASTM D-1238) of 0.85-1.15g / 10min, and the density (ASTM D-792) of 0.9330-0.9370g/cc in 190 **. Usable high density polyethylene is LB 8320-00 by Quantum Chemical Corporation. This material has a melt flow index (ASTM D-1238) of 0.20-0.36g / 10min, and the density (D-1505) of a minimum of 0.9566g/cc in 190 **.
[0031]Usable nylon is Nylon 12 like L2101F Vestamed by Huls America Inc. This material has the relative viscosity (ISO 307) of 2.05-2.22, and a maximum of 0.10 water content (ASTM D-4109). Other usable nylon is PEBA 70D by Elf Atochem. This material The tensile strength of a

minimum of 8300 psi (ASTM D-638), It has a minimum of 400% of elongation (ASTM D-638), a flexibility factor (ASTM D-790) of a minimum of 67,000 psi, a durometer (ASTM D-2240) of 69D**4D, and the melting point (ASTM D-3418) of 160 ** - 180 **.

[0032]Usable high density polyethylene is LM6007 by Quantum Chemical Corporation. This material has the following characteristics.

Tensile strength A minimum of 4400 psi (ASTMD-638)

it can set to a burst -- being extended -- % -- a minimum of 600% (ASTM D-638)

D coefficient 68**4.5 of a durometer (ASTM D-2240)

0.070 (REF) at 240 ** and 2160 g

Melt flow index (ASTM D-1238)

Flexibility factor in a room temperature A minimum of 220,000 psi (ASTM D-790, the technique B)

Vicat softening temperature, ** 125 ** (REF)

(ASTM D-1525)

[0033]When it is requested that the tip part of the catheter shaft 12 is softer than other portions of a shaft, usable suitable nylon is PEBA 63D by Elf Atochem. This material The tensile strength of a minimum of 8100 psi (ASTM D-638), It has a minimum of 300% of elongation (ASTMD-638), a flexibility factor (ASTM D-790) of a minimum of 49,000 psi, a durometer (ASTM D-2240) of 63D**4D, and the melting point (ASTM D-3418) of 160 ** - 180 **.

[0034]The catheter shaft 12 provided with the lumen of a desired number can be manufactured by the conventional extrusion process. In order to form the expanding part of the catheter shaft 12, a vamp extrusion process can be used as known in conventional technology. It can replace with the integral-type catheter shaft 12 with a lumen, and two or more individual tubes connected mutually can be used.

[0035]The elastic chip 96 can be attached to a catheter shaft by carrying out heat adhesion in a prescribed position by arranging the small tube of the charge of a chipped material on the tip of the catheter shaft 12. Similarly, adhesives can be used. The catheter shaft 12 will increase the charge of a tube material. In order to maintain the outer diameter of the catheter shaft 12 after arrangement of the tube of the charge of a chipped material smaller than about 0.056 inch (1.42 mm), In advance of attachment of the charge of a chipped material, only a suitable quantity "being able to shut (necked-down)" the tip part of a catheter shaft. [make able to decrease it or] In order to attach an elastic chip by heat adhesion, maintaining the lumina 14 and 16 to an opening state, an axis is inserted into each lumen. The tube of the charge of a chipped material can extend even to the field to which the tip blockade balloon 22 of the catheter shafts 12 is attached. In this case, all or some of balloons 22 can attach to the charge of a chipped material.

[0036]At the time of heat adhesion of the charge of a chipped material, the tip part of the 3rd

lumen 18 and the 4th lumen 20 is blockaded. When it is required to blockade more portions of one of lumina, the small solid tube made from the same material as the catheter shaft 12 is inserted into the end face of the lumen, and heat adhesion is carried out after that in a prescribed position. Adhesives can be used similarly. The thing large more slightly than the diameter of said lumen of the outer diameter of a tube is preferred. An axis maintains other lumina to an opened condition. When the 3rd lumen 18 is not blockaded at the time of attachment of the elastic chip 96, it can blockade like the 4th lumen.

[0037]The seal of the base end of the 1st lumen 14 and the 2nd lumen 16 can be carried out similarly.

[0038]The blockade balloons 22 and 24 Nylon, polyamide, a polyamide copolymer, It can form from polyethylene, polyethylene terephthalate, a polyester elastomer, polyurethane, Kapton (Kraton), silicone, latex, or other arbitrary flexible non-thrombogen formation materials. Although the blockade balloons 22 and 24 do not blow up a blood vessel wall when it swells, they carry out the seal of the blood vessel wall. A balloon can be used as the balloon by which could consider it as the tube which swells by expansion, or blow molding was carried out. When balloon material has conformity to the catheter shaft 12, the blockade balloons 22 and 24 can be attached by heat adhesion art including laser adhesion. The device and method for carrying out laser adhesion of the balloon on a catheter are indicated by U.S. Pat. No. 5,267,959. This literature is incorporated here for reference. Adhesives can be used similarly. Nylon usable as the blockade balloons 22 and 24 is L25G Grilamid by EMS-Chemie AG. This material The melting point of 178 **, the density of 1.01 kg/dm^3 (DIN 53479), It has the tensile strength (DIN 53455) of 40N[/mm]^2, the elongation (DIN 53455) in 10% of burst, and the Shore (Shore)D hardness (DIN 53505) of 72.

[0039]After expansion is attained by the usual method, the catheter for drugs conveyance by a 1st embodiment of this invention can be used even for the treatment part by the PTA method or the PTCA method in order to convey drugs. An expansion catheter consists of a quick exchange format which is indicated by Mr. Bonzel's U.S. Pat. No. 4,762,129 preferably, for example. This literature is incorporated here for reference. Such a catheter is removed first. After that, the catheter 10 for drugs conveyance of this invention is introduced in a blood circulatory system, and is carried forward even to an expansion part via a guiding catheter along with the same guidewire that showed said expansion catheter even to the strangulation part. An exchange wire is not required at all and the guidewire needs to project only about 75 cm from the body. The tip of the 1st lumen 14 of the catheter 10 is inserted into a guidewire like the guidewire 28 shown in drawing 1. When a catheter advances along with a guidewire, the guidewire has come out of the opening 30 of the catheter 10. The catheter 10 continues being conveyed along with the portion located in the 1st lumen 14 of the guidewires, when moving forward even to an expansion part.

[0040]The progress condition of the catheter 10 is pursued by X-ray fluorography. When it arrives at an expansion part, it swells through the 3rd lumen 18 until the blockade balloons 22 and 24 carry out the seal of the arterial wall in contact with an arterial wall. When the openings 32 and 30a for inflow exist, it flows through the 2nd lumen 16 and the 1st lumen 14, and flows out of the tip part of the catheter 10, respectively. When it is constituted so that the catheter 10 can perform active inflow (.) Namely, when the 2nd lumen 16 has extended covering the whole length of the catheter shaft 12. Blood or a fault fluorine compound like Fluosol (registered trademark), and recombination nature hemoglobin can be poured in by a syringe via the tube 76 as known in conventional technology.

[0041]An anti-thrombolysis agent, an anti-growth agent, or drugs arbitrary type [other] can be poured in by a syringe here through the tube 72, the 4th lumen 20, and also the port 36 for drugs conveyance. One effective gestalt of drugs is the dexamethasone made to stick to the polylactic acid / polyglycolic acid particles of a diameter smaller than 100 microns substantially. Such particles stick to an arterial wall, or can penetrate an arterial wall. A particle surface can be processed with cell adsorptivity protein, in order to heighten the adsorption power of the particles to an arterial wall. Peptide based on usable arginine glycine aspartic acid is Peptite 2000 (registered trademark) by Telios Pharmaceuticals and Inc.

[0042]After continuing for desired time (typically about 20 seconds - 3 minutes) and applying drugs by a desired pressure, a blockade balloon is ******(ed) and the catheter 10 for drugs conveyance is drawn out promptly and easily from a blood vessel.

[0043]Drawing 7 is a figure showing the tip part of a 2nd embodiment of this invention in a flat surface and a section, and the catheter 100 which can perform both extension and drugs conveyance is shown. The catheter 100 is provided with the catheter shaft 110 which has the 1st lumen 112, the 2nd lumen 114, the 3rd lumen 116, and the 4th lumen 118. The inflation balloon 120 and the two blockade balloons 122 and 124 are attached to the catheter shaft 110. The free passage of the 1st lumen 112 and a fluid of the inflation balloon 120 is enabled through the opening 126. The free passage of the 4th lumen 118 and a fluid of both blockade balloons is similarly enabled through the opening 128. The wall of the catheter shaft 110 is penetrated in the 2nd lumen 114, the port 130 is established in it, it can let this port 130 pass, and medication to an expansion part can be performed. The additional lumen for drugs conveyance can be provided like the above. The additional lumen can provide a fluid to the blockade balloons 122 and 124 as opposed to the inflation balloon 120 similarly. The wall of the catheter shaft 110 is penetrated to the 3rd lumen 116, and the opening 132 is formed in it. The 3rd lumen 116 that penetrated the opening 133 in the tip 134 of the catheter 100, and has extended has accommodated the guidewire 136 which exists in this lumen 116 through the opening 132. an additional lumen (not shown) -- it may provide for active or passive inflow. The tip of such a lumen for inflow is preferably made into tapered shape as mentioned above. The

above slide coating is applied to the inflation balloon 120 and the remaining portion of the catheter 100. As mentioned above, it can replace with the integral-type catheter shaft which has two or more lumina, and the catheter shaft 110 can consist of two or more tubes combined appropriately mutually.

[0044]The inflation balloon 120 can be made into the thing of the suitable arbitrary types for the PTA method and the PTCA method, and size. For example, the balloon 120 can be formed from polyethylene, polyethylene terephthalate, nylon, polyamide, a polyamide copolymer, polyurethane, or other arbitrary materials suitable as an inflation balloon. the balloon 120 -- adaptability and non-adaptability -- or -- half--- suppose that it is flexible. The inflation balloon 120 can be attached to the catheter shaft 110 with the heat adhesion including laser adhesion or ultrasonic bonding or adhesives as known in conventional technology. As for the balloon 120, it is preferred that it is the same material as the catheter shaft 110, or is a conformable material so that heat adhesion may be possible.

[0045]Low density polyethylene usable as the inflation balloon 120 is P.E.1031 by RexeneCorporation. In 190**0.2 **, this material The melt flow index of 0.4-1.4g / 10min (ASTM D-1238), It has the density (ASTM D-1505) of 0.93**0.02g/cc, and the melting point (ASTM D-3417, D-3418) of 104-140 **. Usable linearity low density polyethylene is Dowlex2247A LLPDE by Dow Chemical Corporation. In 190 **/2.16 kg, this material The melt index of 2.0-2.6g / 10min (ASTM D-1238), It has the density (ASTM D-1505) of 0.9150-0.9190g/cc, and the melting point (D-3417, D-3418 (REF)) of 122-125 **.

[0046]The material mentioned above in relation to a 1st embodiment is suitable for other corresponding members in this embodiment. The radiation opaque marker 138 is established under the blockade balloons 122 and 124 under the inflation balloon 120 like a 1st embodiment again at the catheter shaft 110. The structure of the end face of the catheter 100 is intrinsically [as the end face of the catheter 10 shown in drawing 1] the same. However, only the point that the 3rd tube for supplying the fluid for expansion to the inflation balloon 120 through the 1st lumen 112 is attached is different from the end face of the catheter shaft 110. Y adapter can be used again as known in conventional technology.

[0047]At the time of use, the catheter 100 of this embodiment is inserted in a guidewire like the guidewire 136 already advanced even to the strangulation part by the guiding catheter as known in conventional technology. It invaded through the opening 134 in the catheter 100, and has come out from the 3rd lumen 116 through the opening 132. As mentioned above, when some catheters 100 are carrying out friction engagement with the guidewire, while being able to follow a catheter to a strangulation part easily and promptly, the guidewire to be used is short and ends. When arranged properly, the inflation balloon 120 can swell by the conventional method, in order to open a strangulation part. Then, it is made to become narrower about the inflation balloon 120, and the blockade balloons 122 and 124 can be blown

up as mentioned above. The drugs of arbitrary requests can be supplied through the 2nd lumen 114 after that. By the ability to perform both extension and drugs conveyance as it is also with the same catheter, in this embodiment, time required to draw out the catheter for expansion and insert the catheter for drugs conveyance of a different body further can be saved, and operation time can be shortened. In addition, in this embodiment, the problem of the exact rearrangement to the expansion part for the optimal location and allocation of the catheter for drugs conveyance can be eased.

[0048]In a 3rd embodiment of this invention, both extension of a strangulation part and drugs conveyance to an extended part can be performed as, as for the catheter 200, the same inflation balloon is also. Drawing 8 is a figure showing the tip part of such a catheter 200 in a flat surface and a section, and the state where the inflation balloon expanded is shown. The catheter 200 is provided with the catheter shaft 210, the 1st lumen 212, the 2nd lumen 214, and the 3rd lumen 216. The 2nd lumen 214 has accommodated the guidewire 218 through the opening 219. In order to form the exit of the guidewire 218, the catheter shaft 210 is penetrated in the 2nd lumen 214, and the opening 217 is formed in it. It can replace with the integral-type catheter shaft which has two or more lumina, and the catheter shaft 210 can consist of two or more tubes combined appropriately mutually.

[0049]The balloon part of the catheter 200 is provided with the outside balloon 220 and the inner balloon 230. The 2nd lumen 214 inserted in the inside of the inner balloon 230, and has extended. The tip of the outside balloon 220 is pasted up with heat or adhesives to the tip of the inner balloon 230.On the other hand, at the place 240, the tip of the inner balloon 230 is pasted up with heat or adhesives to the outside surface of the 2nd lumen 214. Both the end faces of the outside balloon 220 and the inner balloon 230, To the catheter shaft 210, it is in the state in which the middle field of an outside balloon and an inner balloon is carrying out fluid communicating to the 1st lumen 212, and has pasted up with heat or adhesives in the state where the inside of the inner balloon 230 is carrying out fluid communicating to the 3rd lumen 216. The fluid for expansion is supplied through the 3rd lumen 216, and drugs are supplied through the 1st lumen 212. In order that two or more micropores 280 may emit drugs from a balloon, the wall of the outside balloon 220 is penetrated and it is formed. Such a hole can be 0.01 micron - 0.1 mm. When the outer layer of the balloon 220 is provided with polyethylene terephthalate, nylon, or biaxial orientation plastic material like a polyester elastomer, the micropore 280 can be formed using high-precision laser.

[0050]At the time of use, the guidewire 218 is advanced to the fault part with which it should deal via a guide catheter by the conventional method. The tip of the 2nd lumen 214 is attached over the base end of the guidewire 218. The guidewire has come out from the catheter 200 through the opening 217 like both the above-mentioned embodiments. The catheter 200 continues advance along with the portion in the 2nd lumen 214 of the guidewires until it arrives

at the fault part where it should deal with a balloon part. In drawing 8, the inner layer 230 and the outer layer 220 of the balloon part are illustrated by the expanding state, however when these layers move forward to a strangulation part, they are in the state where it stuck to the outside surface of the lumen 214.

[0051]If the tip part of the catheter 200 is appropriately arranged using the radiation opaque marker band 242, selected drugs will let the 1st lumen 212 pass, and will be introduced into the staging area of outside balloon 220 and the inside balloon 230. Although pouring of drugs brings about some extension of the outside balloon 220, typically, the pressure that drugs are poured in is smaller than the pressure that the quantity of drugs will be substantially emitted from the micropore 280. In order to perform both drugs conveyance and extension simultaneously next, the fluid for expansion lets the 3rd lumen 216 pass, and is poured in inside the inner balloon 230. If a pressure increases and 7-8 atmospheres will be reached typically, the inner layer 230 of a balloon will swell even to a predetermined maximum diameter. And by swelling in this way, to the fault part with which it deals that it is also with special drugs, it can let the port 280 pass and drugs can be sprinkled effectively. While the pressure which acts to a fault part is brought about again and drugs apply by expansion of the inner balloon 230, forcing to a blood vessel wall can be performed.

[0052]Use of the balloon for conveyance of the drugs to the expansion part by the catheter for drugs conveyance of this invention is shown in a 4th embodiment of drawing 9. The catheter 300 is provided with the balloon 312 for drugs conveyance attached by heat or adhesives to the catheter shaft 310 as mentioned above. The balloon 312 is shown by the expanding state in drawing 9. Two or more ports 314 for drugs conveyance are formed over the balloon 312. The balloon 312 lets the port 318 which penetrates the wall of the catheter shaft 310 pass, and is carrying out fluid communicating to the lumen 316 for drugs conveyance. The additional lumen for drugs conveyance can be provided again. The lumen 320 for guidewires penetrates the tip 322, and is provided in the tip part of the catheter shaft 310. The termination of the lumen 320 for guidewires is carried out to the end face side of the balloon 312 for drugs conveyance of the tip parts of the catheter shaft 310. The opening 324 which is open for free passage to the lumen 320 for guidewires is formed in the wall of the catheter shaft 310. The guidewire 326 can be inserted through the opening 328 in the tip 322 of the catheter shaft 310, and can be taken out through the opening 324.

[0053]It is preferred to form the lumen 330 for inflow in which the tapered shape end 330a was formed. As mentioned above, this lumen can extend covering the whole length of the catheter shaft 310 so that active inflow may be enabled. It can replace with this and the termination of this lumen can be carried out to the end face side of the balloon 312 for drugs conveyance. In that case, in order to enable active inflow, like a 1st embodiment, the wall of the catheter shaft 310 can be penetrated and two or more openings (not shown) can be provided. It can replace

with the integral-type catheter shaft provided with two or more lumina, and the catheter shaft 310 can consist of two or more tubes pasted up appropriately mutually.

[0054]A 5th embodiment of the invention in this application combines a space expansion function and a local drugs carrying function with the balloon extension type stent. The non-expanding state and the expanding state are shown in drawing 10, 11 and drawing 12, and 13, respectively. The catheter 400 is provided with the object for double-wall type expansion and the balloon 412 for drugs conveyance which it was welded or were pasted up on the catheter shaft 401 like ****, the 1st lumen 405, the 2nd lumen 406, and the 3rd lumen 407. The 2nd lumen 406 has received the guidewire 418 through the opening 419. To the 2nd lumen 406, the catheter shaft 401 is penetrated and the opening 417 is formed. This opening 417 can make the exit for the guidewire 418. It can replace with the integral-type catheter shaft in which two or more lumina are provided, and the catheter shaft 401 can also consist of two or more tubes pasted up mutually again.

[0055]The double-wall balloon 412 is the same as the double-wall balloon in a 3rd embodiment of this invention. The stent 440 which can be balloon expanded is attached to the double-wall balloon. Means of attachment can be performed by other arbitrary methods of demounting the stent from a double-wall balloon at the time of engagement, and balloon expansion and stent deployment.

[0056]At the time of use, the guidewire 418 is advanced to the fault part with which it should deal via a guide catheter by the conventional method. The tip 419 of the 2nd lumen 406 is attached over the base end of the guidewire 418. The guidewire has come out from the catheter 400 through the opening 417 like both the above-mentioned embodiments. The catheter 400 continues advance along with the portion in the 2nd lumen 406 of the guidewires until it arrives at the fault part where it should deal with a balloon part. In drawing 10 - drawing 13, the inner layer 430 and the outer layer 420 of the balloon part are illustrated by the expanding state, however when these layers move forward to a strangulation part, they are in the state where it stuck to the outside surface of the lumen 419.

[0057]If the tip part of the catheter 400 is appropriately arranged using the radiation opaque marker band 442, selected drugs will let the 3rd lumen 407 pass, and will be introduced into the staging area of outside balloon 430 and the inside balloon 420. Although pouring of drugs brings about some extension of the outside balloon 430, typically, the pressure that drugs are poured in is smaller than the pressure that the quantity of drugs will be substantially emitted from the micropore 428. In order to perform drugs conveyance, extension of strangulation, and arrangement of the stent simultaneously next, the fluid for expansion lets the 1st lumen 405 pass, and is poured in inside [421] an inner balloon. If a pressure increases and 7-8 atmospheres will be reached typically, the inner layer 420 of a balloon will swell even to a predetermined maximum diameter. And while being able to sprinkle drugs effectively to the

fault part with which it deals that it is also with special drugs by swelling in this way, the stent is expanded and the stent can be pushed to a blood vessel wall. Drugs are emitted from the hole of an outside balloon and permeate through the lattice of the stent.

[0058]In the catheter for drugs conveyance and the catheter for expanded type drugs conveyance by this invention, advance and drawing out of a quick and easy catheter are possible, and, therefore, the time which an operation takes can be shortened. A required staff and device can be omitted and operation cost can be reduced.

[0059]In the above, although the desirable embodiment of this invention has been described, the above-mentioned embodiment does not restrict the range of this invention, and the range of this invention is defined by the claim.

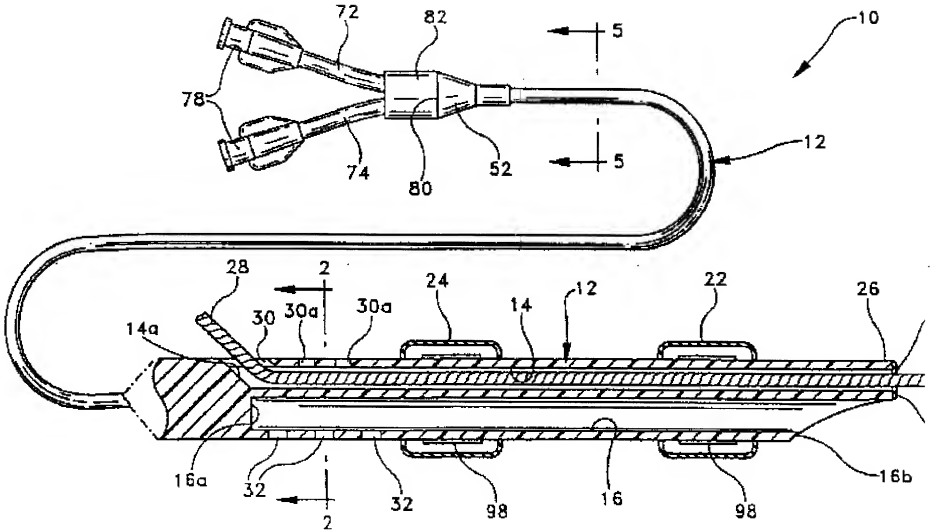
[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a figure showing the catheter for drugs conveyance by one embodiment of this invention, and about the tip part of the catheter, it expands and is illustrated in the section.
[Drawing 2]It is a sectional view showing the tip part of the catheter shown in drawing 1 along two to 2 line of drawing 1.
[Drawing 3]It is a sectional view in which 90 degrees' rotating and showing the tip part of the catheter shown in drawing 1.
[Drawing 4]It is a sectional view showing the tip part of the catheter shown in drawing 3 along four to 4 line of drawing 3.
[Drawing 5]It is a sectional view showing the base end of the catheter shown in drawing 1 along five to 5 line of drawing 1.
[Drawing 6]It is a top view showing the catheter shown in drawing 3 with the blockade balloon which expanded.
[Drawing 7]It is a figure showing the tip part of a 2nd embodiment of this invention in a flat surface and a section.
[Drawing 8]It is a figure showing the tip part of a 3rd embodiment of this invention in a flat surface and a section.
[Drawing 9]It is a figure showing a 4th embodiment of this invention in a flat surface and a section.
[Drawing 10]It is a figure showing a 5th embodiment of this invention.
[Drawing 11]It is a figure showing a 5th embodiment of this invention.
[Drawing 12]It is a figure showing a 5th embodiment of this invention.
[Drawing 13]It is a figure showing a 5th embodiment of this invention.
[Description of Notations]
400 Catheter

401 Catheter shaft
405 Lumen
406 Lumen
407 Lumen
412 Balloon
417 The 2nd opening
418 Guidewire
419 Tip
420 Inner layer
428 (For drugs discharge) Opening
430 Outer layer
440 Stent

[Translation done.]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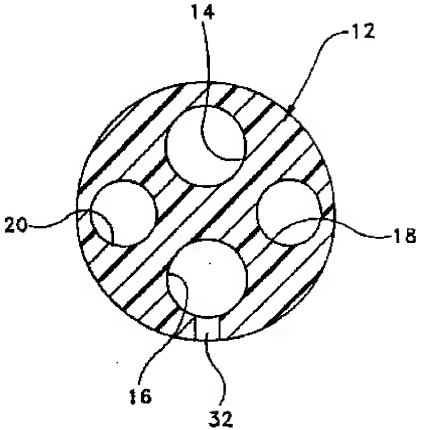
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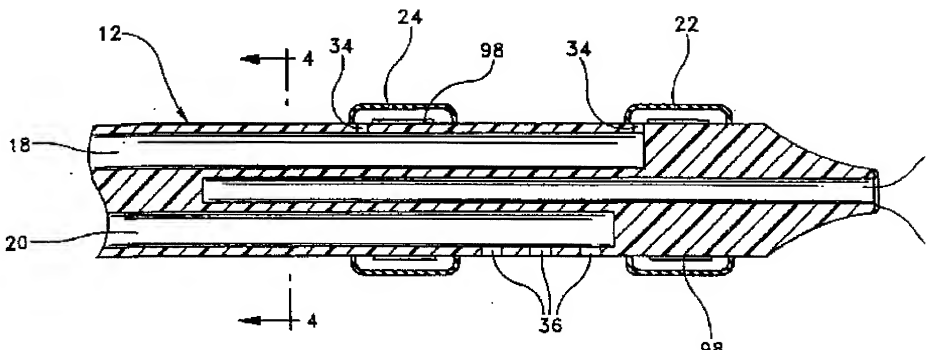
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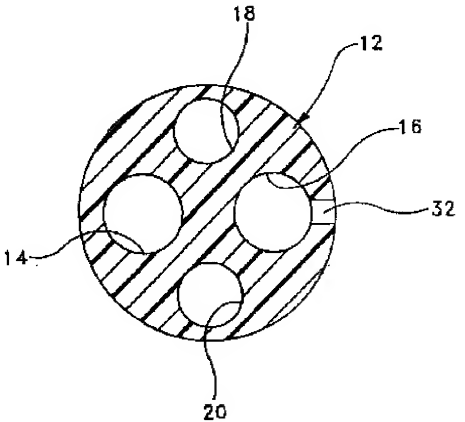
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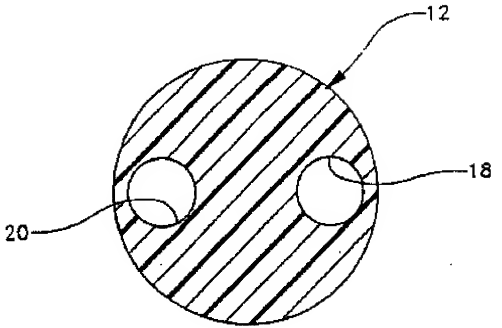
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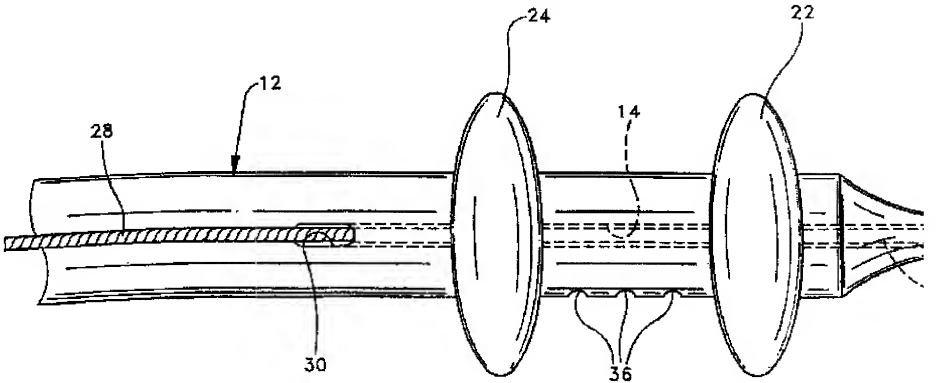
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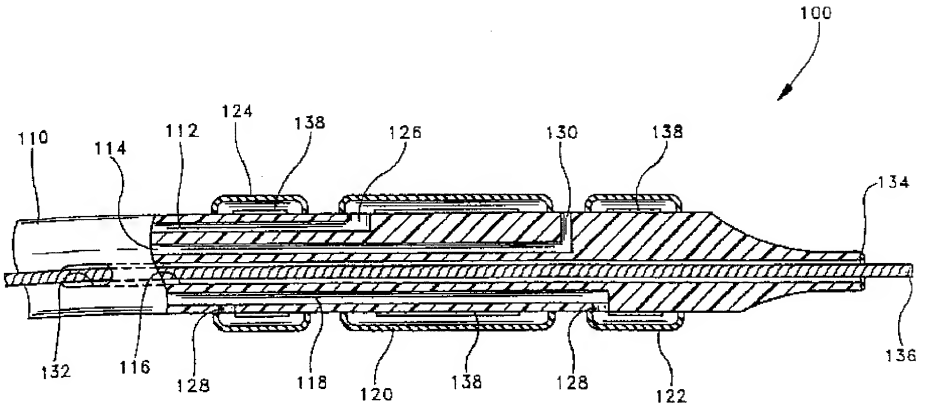
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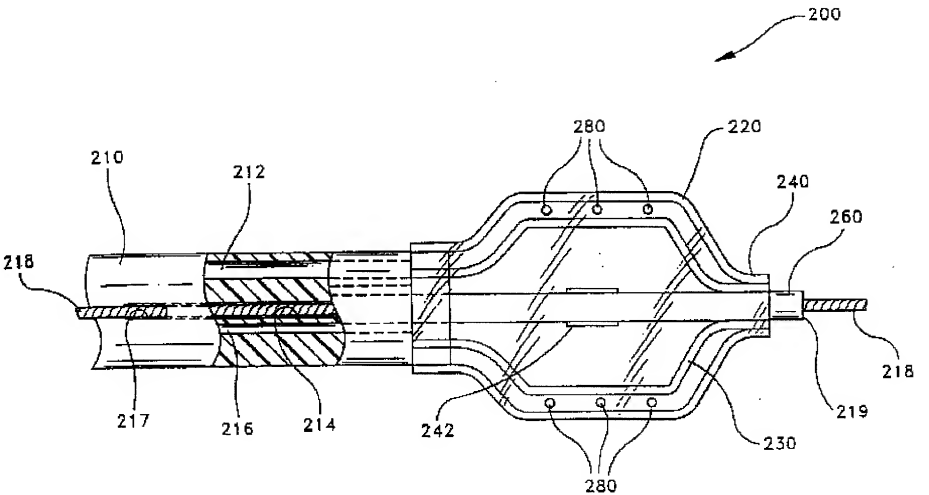
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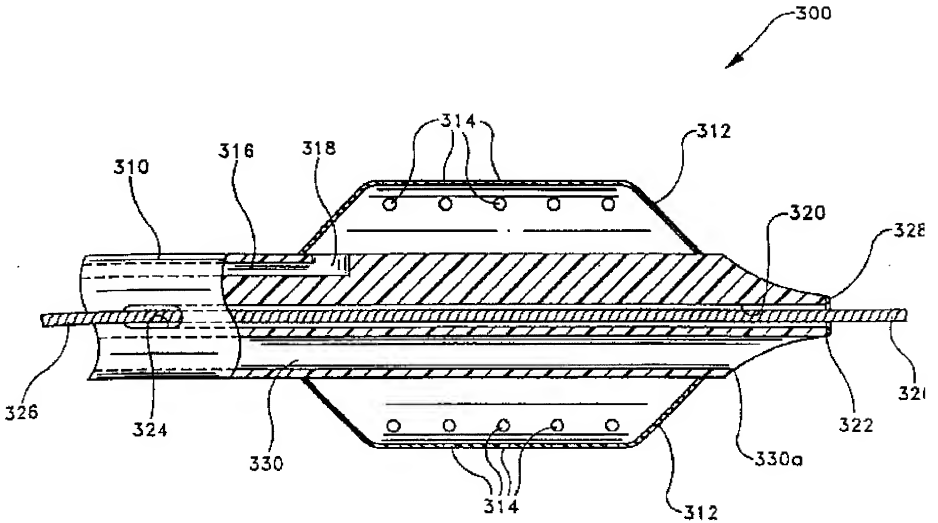
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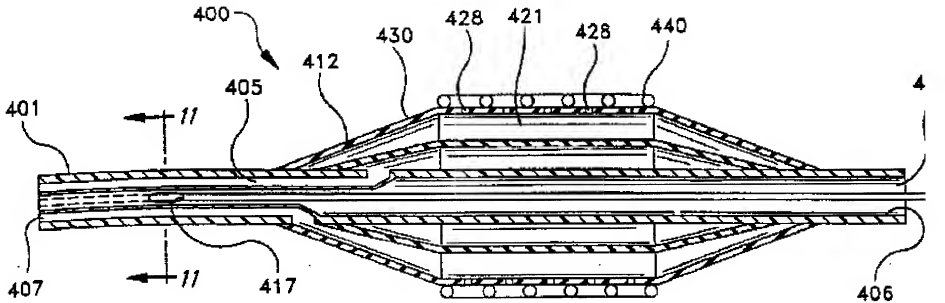
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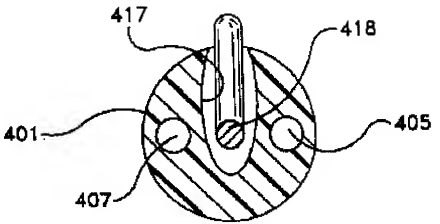
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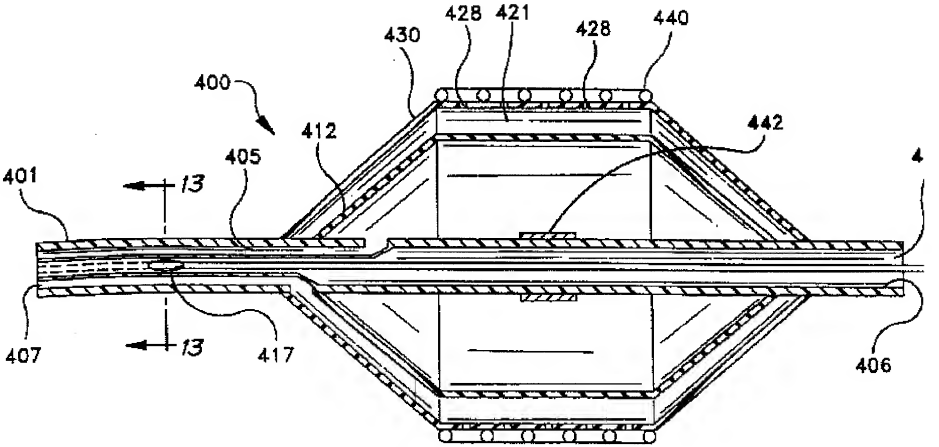
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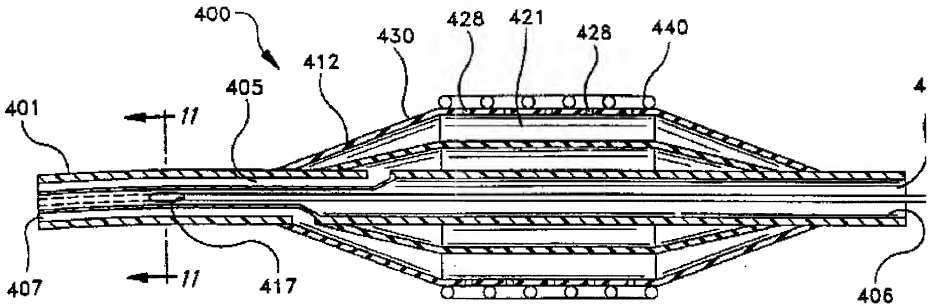
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